

Compressed Air

Magazine

SEPTEMBER 1957



SULLEN WATERS

AT RIPPLE ROCK

Picturesque Seymour Narrows
Harbors Hidden Menace
To Marine Traffic

(See INDEX PAGE AND PAGE 256)

VOLUME 62 • NUMBER 9

NEW YORK • LONDON

Air Casualties

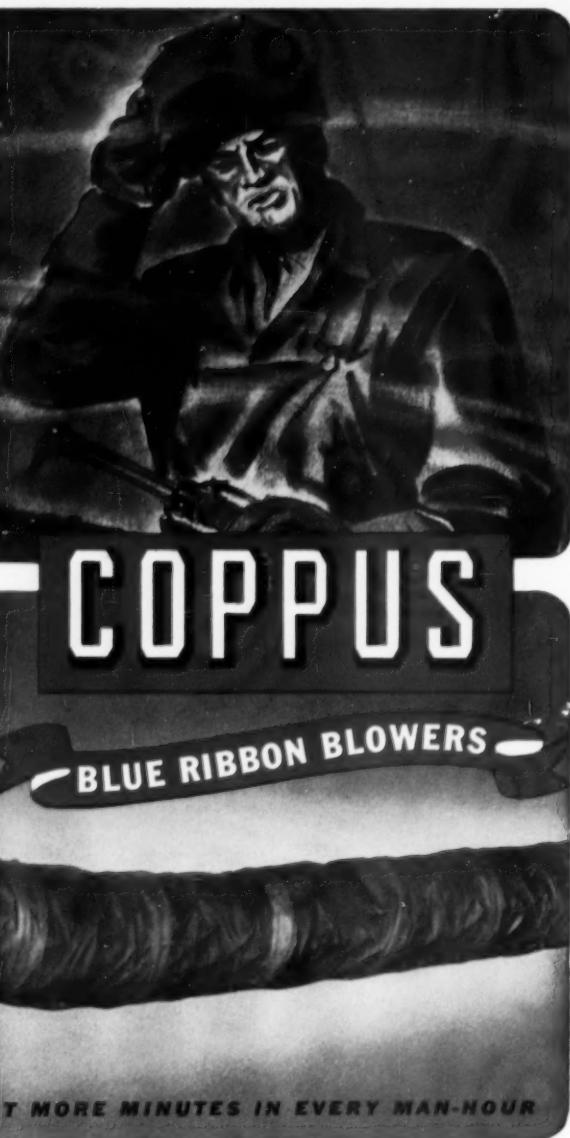
It's bad air that does it. But you can step up production by putting a Coppus Blower on the job to keep the air moving — and keep the men cool.

The kind of air a man works in has a lot to do with how much work he can turn out.

In confined places like shipholds or tanks or drums or boilers . . . or wherever the air is stagnant or hot or full of fumes . . . a Coppus Blower is a *must* for getting first-class work out of the men, all the time.

A Coppus Blower or Exhauster helps avoid sickness and lassitude due to bad air . . . and improves morale, too.

Portable and adaptable for special purposes, Coppus Blowers and Exhausters will have dozens of uses around your plant. The "Blue Ribbon" (a blue painted band) is your assurance of quality performance at lowest cost.



THE BLOWERS THAT PUT MORE MINUTES IN EVERY MAN-HOUR

CABLE MANHOLE AND TANK VENTILATORS — BOILER MANHOLE BLOWERS AND EXHAUSTERS — HEAT KILLERS — SHIPHOLD VENTILATORS . . . DESIGNED FOR YOUR INDUSTRY — ENGINEERED FOR YOU

MAIL THIS COUPON To Coppus Engineering Corp., 209 Park Avenue, Worcester 2, Mass. Sales offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in BEST'S SAFETY DIRECTORY.

PLEASE SEND ME INFORMATION ON SUPPLYING FRESH AIR TO MEN WORKING:

- in tanks, tank cars, drums, etc.
- in underground cable manholes.
- in aeroplane fuselages, wings, etc.
- on coke ovens.
- on steam-heated rubber processes.
- on boiler repair jobs.
- COOLING:**
- motors, generators, switchboards.
- wires and sheets.
- general man cooling.
- exhausting welding fumes.
- stirring up stagnant air wherever men are working or material is drying.
- drying of walls, sheets, etc., after treated with coating material.
- around cracking stills.

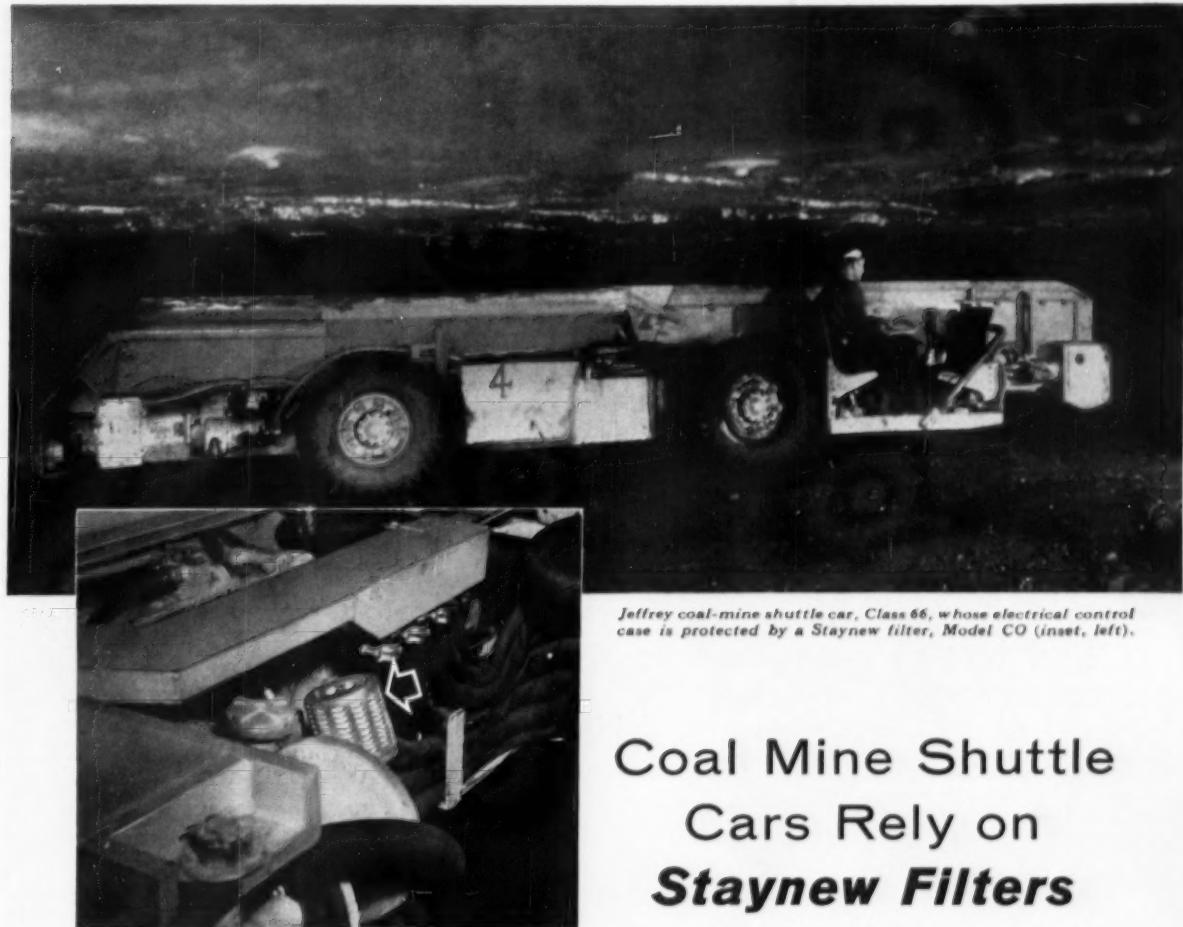
NAME _____

COMPANY _____

ADDRESS _____

CITY _____

(Write here any special ventilating problem you may have.)



Jeffrey coal-mine shuttle car, Class 66, whose electrical control case is protected by a Staynew filter, Model CO (inset, left).

Coal Mine Shuttle Cars Rely on **Staynew Filters**

One of the most fascinating items turned out by The Jeffrey Manufacturing Company, Columbus, O., is its coal mine shuttle car—a long, squat, sturdy truck to carry coal from the face of a mine to an entry conveyor for delivery to a coal-preparation plant.

The car has a four-wheel drive, four-wheel brakes. Capacities range from 2.7 to 9.2 tons, and heights of different models vary to accommodate low-beamed mines.

A centralized control station, located on one side of the car, features a ventilated electrical control case.

In each car's ventilation system a Staynew filter, Model CO, is installed. Ventilation—and consequently air filtration—of the electrical control case reduces corrosion of contacts, wiring, and other metallic parts. It also prevents malfunctioning of

contactors. Coal or other dirty material would otherwise interfere with operation of moving parts, and might sometimes cause short circuits.

Ease of maintenance is one reason for Jeffrey's choice of Staynew filters. Another is compactness, as the amount of space available for installation is limited.

The Staynew Model CO filter is a small-capacity, air-intake filter—inexpensive but efficient—with an aluminum housing whose scientifically designed louvers and openings at the base distribute air evenly over the entire area of the filtering medium.

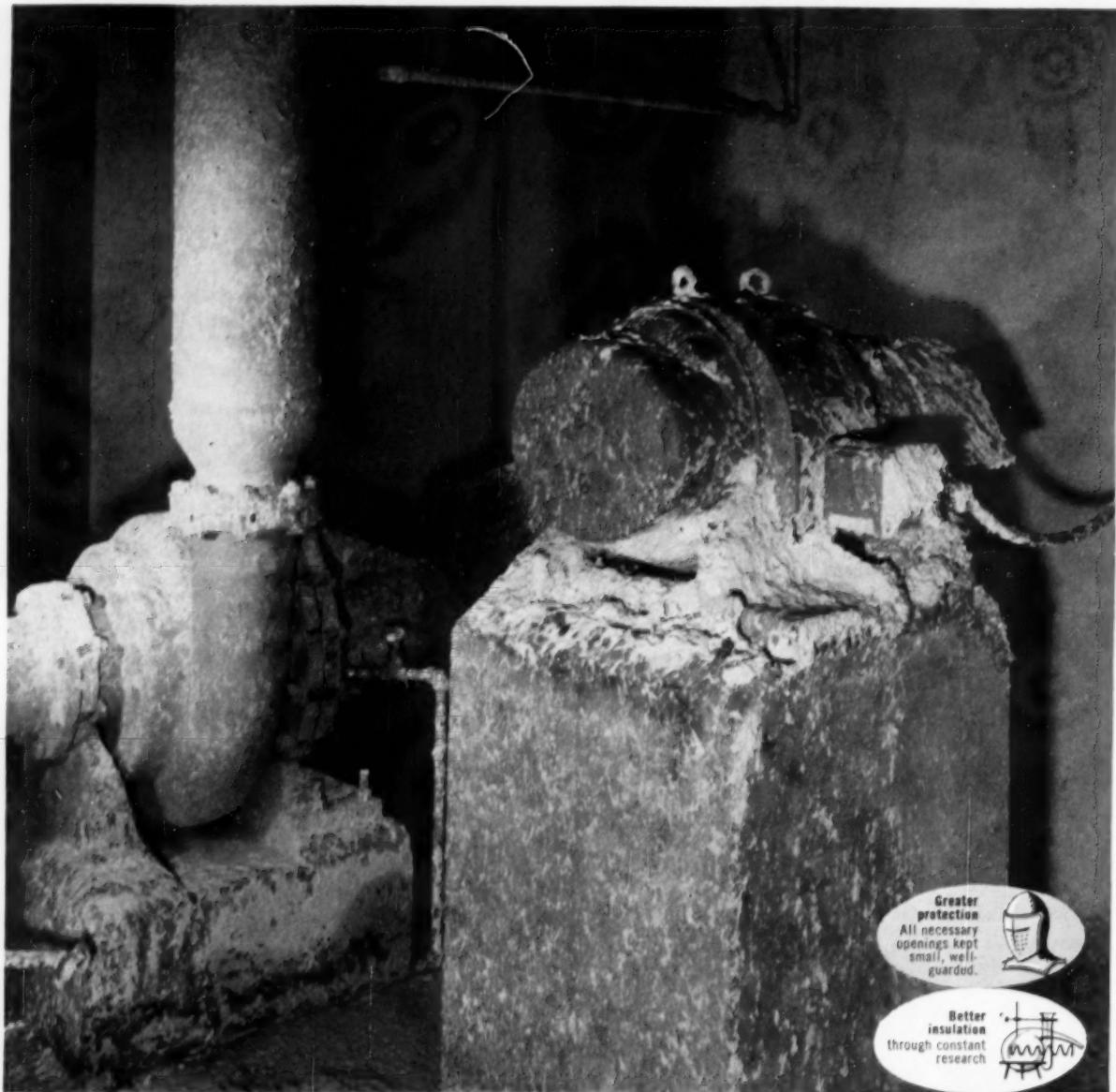
A single through bolt holds the assembly together, making inspection and cleaning fast and easy.

Whatever *your* filtering problems, there's a Dollinger representative nearby ready to help solve it. Write today and ask. Dollinger Corporation, 7 Centre Park, Rochester 3, New York.



DOLLINGER

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS • ELECTROSTATIC FILTERS • MIST COLLECTORS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS • VISCOSITY PANEL FILTERS • LOW PRESSURE FILTERS • HIGH PRESSURE FILTERS • AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS



Be glad you weren't working here...

But this sturdy Louis Allis motor was, and still is!

Shortly before this picture was taken, that pulp-mill pump suddenly ruptured. Blasted every object in the area with a thick coating of hot paper pulp.

But note the Louis Allis 20 HP splash-proof motor designed to take this kind of abuse — and come back for more! Note that it took the full force of this blast on its vented *underside* — a motor's most vulnerable point. Only a sturdy, well-designed motor could resist this. Still functioning perfectly this one didn't miss a beat!

Let us tell you more about Louis Allis electric motors. About such unique features as the new varnish of Gilsonite combined with phenolics and alkyds that provides the highest degree of moisture, acid, and alkali resistance . . . locked bearings that reduce end play and extend bearing life . . . the dynamically balanced rotor. And about the many other Louis Allis extras better discussed at length in our file-sized Reference Bulletin 1700. Why not write for it today? The Louis Allis Co., 437 East Stewart Street, Milwaukee 1, Wisconsin.

LOUIS ALLIS

LA-111
MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

Adv. 4

Circle 3A on reply card

COMPRESSED AIR MAGAZINE

Compressed Air Magazine

Founded 1896

VOLUME 62 NUMBER 9

September 1957

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ON THE COVER

OUR cover picture shows a pair of browsing goats that are seemingly unaware of the hazards the ship in the channel at their left is experiencing. In traversing Seymour Narrows, vessels must wait for slack tide and then rush through to avoid a maelstrom of vicious currents that, in combination with the twin peaks of Ripple Rock shoals, has taken an extensive toll of ships and men. In this month's lead article is told the story of man's efforts to remove the Ripple Rock hazard.

FEATURE ARTICLES

Page 258 Big Blast at Ripple Rock—*J. P. Smallwood*

Favored passage of vessels plying the Pacific Coast of Canada, the waterway between the British Columbia mainland and the innumerable islands just off its coast is generally deep and calm. However in Seymour Narrows, treacherous shoals have taken an extensive toll of ships and men. This article describes man's efforts to remove the rock peaks that form Ripple Rock shoal.

262 Oil Flows in the Sahara

The barren wasteland known as the Sahara Desert has suddenly rocketed to prominence with the discovery of black gold. Substantial reserves are indicated in two fields, and a systematic search, that began as long ago as 1945, is being carried out to locate additional producers. For the most part exploration is of the seismic variety. The role of portable drill rigs is told in this article along with some facts about the Sahara and a description of the seismic exploration method.

266 Washington National Monument—*S. M. Parkhill*

From conception to completion, the tall slender shaft that has come to be a memorial of all that went into the making of America, required a total of 84 years. First organized as a project to be financed by subscribed funds, the original concept was sorely beset by financial difficulties. Eventually Congress supplied the necessary money and, with some revision, the shaft was completed. This article details the history of the Washington Monument. Some interesting construction scenes are reproduced.

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BPA

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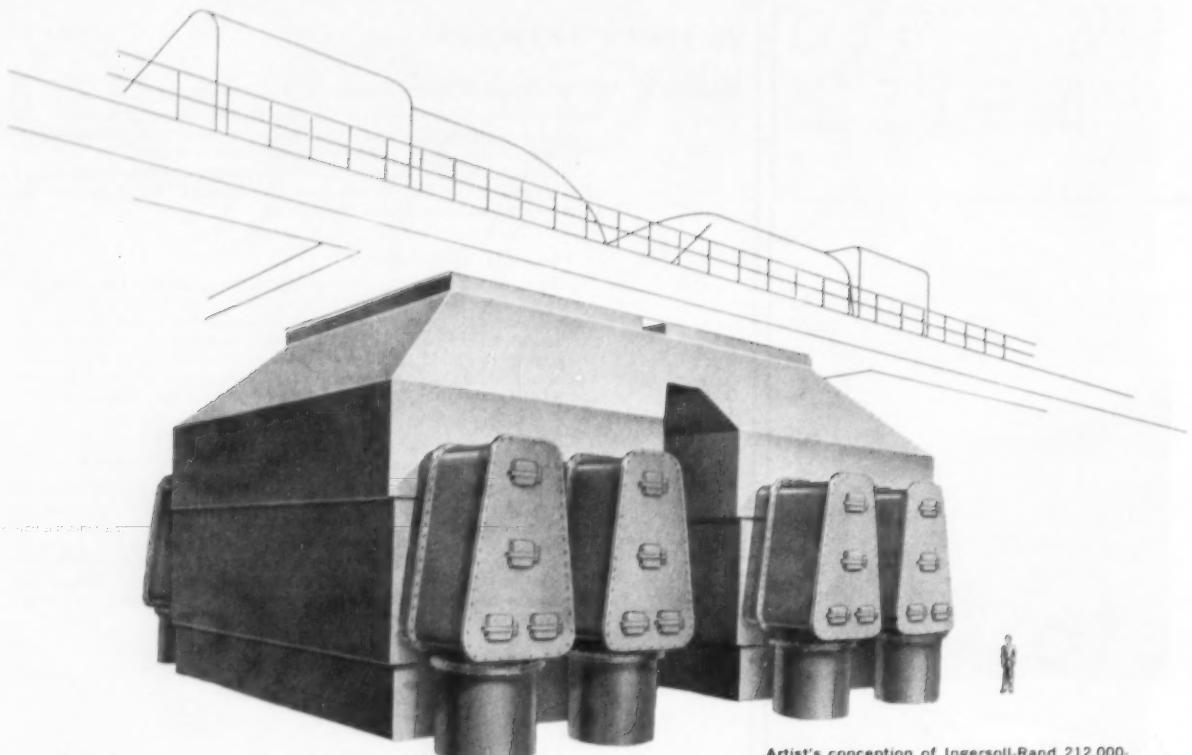
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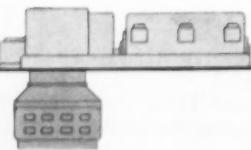
Ingersoll-Rand Twin-Shell

will serve Con Edison's 275,000-kw



Artist's conception of Ingersoll-Rand 212,000-sq ft Twin-Shell Surface Condenser for Con Edison's 275,000-kw Nuclear Power Plant at Indian Point

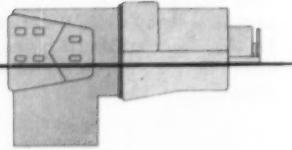
I-R Condensers
set the pace
in meeting
all of today's
turbine-condenser
arrangements



BOTTOM EXHAUST:
Regardless of headroom limitations, I-R surface condensers permit most effective utilization of all available under-turbine space. Sketch above, for example, shows a 65,000-sq ft condenser with headroom of only 14 ft 8 in., serving a 135,000-kw bottom-exhaust turbine.



SIDE EXHAUST: Mounted directly on the turbine floor, the twin shells of this I-R condenser are connected directly to the dual side exhausts of a huge, cross-compound steam turbine serving a large mid-western utility. Such a condenser can be arranged for the most economical design proportions without the usual limitations of headroom and floor space.



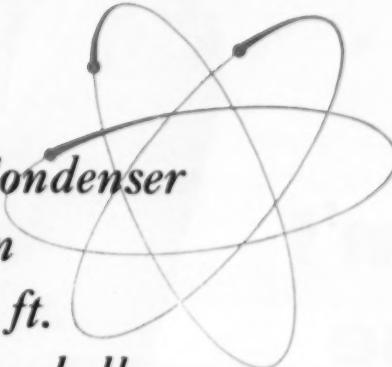
AXIAL EXHAUST: This advanced-design I-R condenser connects directly to the exhaust of an axial flow exhaust turbine. The result of close cooperation between I-R engineers and the turbine designers, it is another outstanding example of the adaptability of I-R condenser design.

PUMPS • COMPRESSORS • STEAM JETS • CONDENSERS

Surface Condenser

NUCLEAR POWER PLANT

*Advanced design I-R Condenser
for Indian Point Station
will contain 212,000 sq. ft.
of cooling surface in two shells*



SCHEDULED for completion in 1960, the Indian Point Nuclear Station of Consolidated Edison Company of New York, Inc., will pioneer many innovations in power plant equipment and design.

The I-R twin shell condenser serving the 275,000-kw turbo-generator unit will be the largest on the Con Edison system. The turbine is an 1800-rpm single shaft, double exhaust unit, and the condenser size is comparable to that of a unit serving a conventional 400,000-kw turbine. The two condenser shells will contain almost 180 miles of tubing with a total condensing surface of 212,000 sq ft. The 31,508 tubes will be welded at both ends into silicon-bronze tube sheets. Special hotwell trays will be provided with a total of

24 sampling connections to permit continuous indication of condensate purity.

Ingersoll-Rand will also supply the boiler-feed pumps, circulating pumps and steam-jet ejectors for the history-making Indian Point Station. The three specially-designed boiler-feed pumps will have a capacity of 2425 gpm at 632-psig discharge. And the two huge vertical circulating pumps will each handle 140,000 gallons per minute.

This outstanding installation is further evidence of Ingersoll-Rand's ability to meet any surface condenser requirements for any turbine-condenser arrangement. Your I-R engineer will be glad to discuss your power plant problems and help you determine the equipment best suited to your needs.



Ingersoll-Rand
11 Broadway, New York 4, N.Y.

AIR & ELECTRIC TOOLS • ROCK DRILLS • TURBO-BLOWERS

4-599

SEPTEMBER 1957

Circle 44 on reply card

ADV. 7

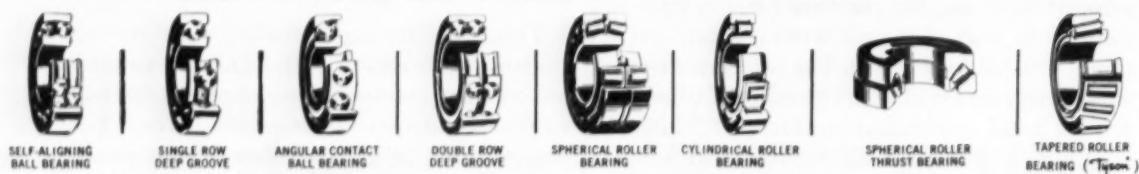
don't lose your head!



When bearings fail, don't go to pieces...get on the phone and tell an authorized **SKF** distributor your troubles. He will help you put things back in order, quickly. Every authorized **SKF** distributor carries a complete line of **SKF** ball and roller bearings and pillow blocks—a type for every use—and he is factory-trained by **SKF** to assist you on any knotty production problems.

Call him for prompt, reliable service on all bearing requirements.

7788



SKF
BEARING REPLACEMENT
SERVICE

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.

*Reg. U. S. Pat. Off. Tyson Bearing Corporation





WIRE ROPE AT WORK

The Roy C. Smith Bridge over the Neponset River, near Milton, Massachusetts, is an important link in Greater Boston's expanding new system of expressways. Because of its high level, this streamlined bridge is the only Neponset River crossing between Milton and the Bay

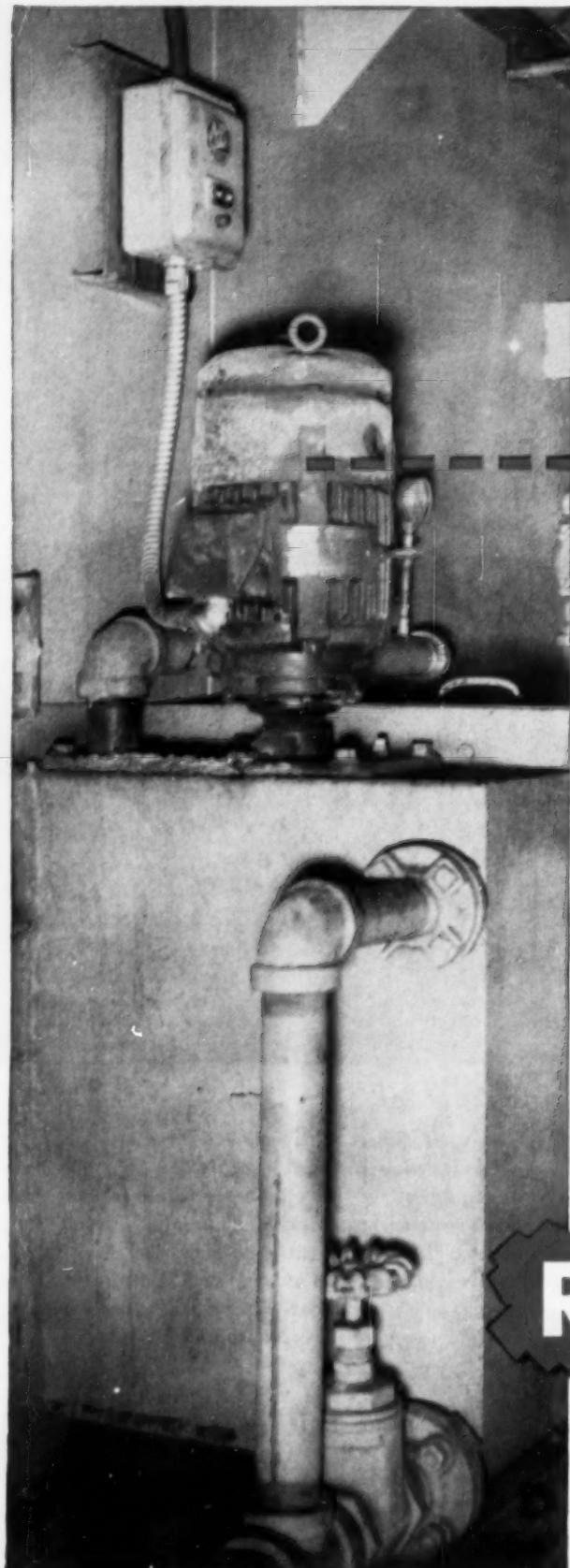
that is not subject to navigational openings.

Construction involved the placing of some heavy plate girders, and the photograph shows one of them being lowered into position. The girder is 106 ft long and weighs approximately 34 tons. Handling of the load was entrusted to strong, flexible Bethlehem wire rope, Purple Strand grade—a top-quality rope that makes even the touchiest jobs seem routine.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:
CONSTRUCTION • EXCAVATING • MINING • QUARRYING • PETROLEUM • LOGGING • MANUFACTURING





RELIANCE solves motor corrosion problem

This Reliance Corrosion-Proof Motor is operating a pump which circulates cleaning solution through a tank containing metal parts. The motor is subjected to corrosive vapors and liquids each time a basket of parts is removed. **BUT THIS MOTOR WILL NOT CORRODE.**

The solid cast-iron housing, including the fan cover, will withstand corrosive service indefinitely. Wiring identification is preserved on a stainless steel name plate. A threaded outlet is provided on the water tight conduit box, and motor leads are molded into a neoprene gasket that completely seals off the windings from the conduit box. A neoprene or non-ferrous shaft slinger seals the only other frame opening.

These and many other features give you a motor with a built-in corrosion protection. Why not install this superior design now and save many replacement dollars in the years ahead.

Write for bulletin B-2406 for complete design details.

B-1534

R

RELIANCE ELECTRIC AND
ENGINEERING CO.

DEPT. 79A, CLEVELAND 17, OHIO
CANADIAN DIVISION: WELAND, ONTARIO

Sales Offices and Distributors
in Principal Cities

how to get the most out of HOLLOW DRILL STEEL

Detachable carbide insert bits are a cost-cutting tool for the hard rock driller. But their use presents problems to the blacksmith. One problem is the premature failure of the attachment on the drill rod. When that happens, time is wasted in trying to recover the bit and, often, valuable bits are lost.

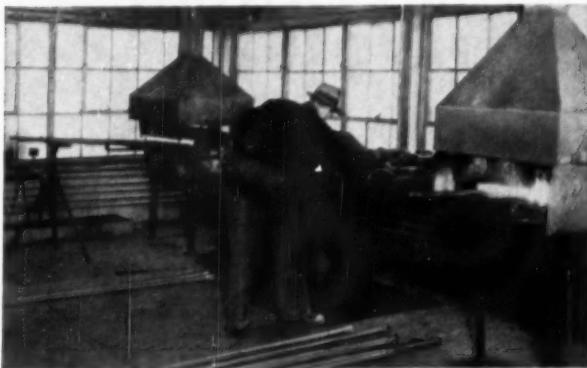
But, with new alloy steels such as Crucible CA DOUBLE DIAMOND or 4E, plus careful control of operations in the forge shop, you can keep failures to a practical minimum.

For example, prevent SCALING OF THREADED SECTION



Excess scaling may produce undersize threads, loose fitting bits and ultimate mechanical failure of the drill rod due to poor stress distribution. Here are a few precautions to take to prevent excess scaling:

TIME AND TEMPERATURE—



Of primary importance are the time and temperature which the heat-treater selects for the job. Although they will vary somewhat with the composition of the steel and the size of the rod, time and temperatures should be selected which are the minimum at which the desired result can be obtained. Excess furnace time or temperature will result in excessive scale formation.

FURNACE ATMOSPHERE — Avoid a highly oxidizing flame. The higher the excess oxygen content, the greater the tendency for scale and decarburization to form. And a reducing flame leads to carburizing brittle threads. The furnace best operates with a "soft" smoky flame or under near neutral conditions.

SCALE REMOVAL—



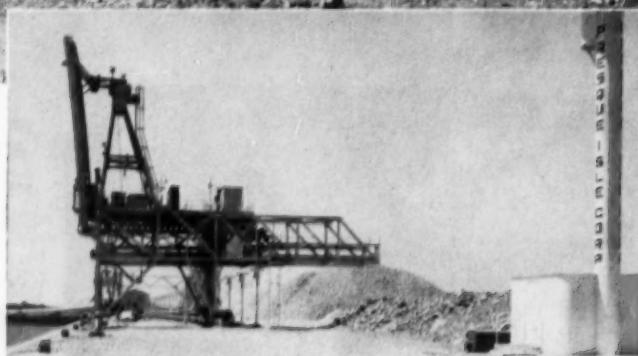
Scale is abrasive, and unless what scale does occur is removed, thread wear results. Wire brushing is a fast, convenient and safe method for removing scale.

Crucible hollow drill rods are tough, strong—made to tool steel standards. Their *extra* quality means less rod breakage—fewer valuable bits lost. So specify Crucible hollow drill rods for your next job. They're quickly available in the sizes, types and grades you need. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE

first name in special purpose steels

Crucible Steel Company of America



◊ This is one of three 190-B shovels used to load out limestone from Presque Isle Corporation's quarry at its Stoneport location.

◊ Here is Presque Isle Corporation's loading site at Alpena, Mich.

*In Michigan . . .
and the world over*

WHERE DEPENDABILITY IS ESSENTIAL BUCYRUS-ERIES ARE FAVORITES

The entire production of the Presque Isle Corporation's limestone quarry and crushing plant is transported by boat. Consequently, operation of the 1740-ton-per-hour plant is limited to the length of the shipping season on Lake Huron. To keep its Stoneport (Mich.) operation going at full capacity during this shortened working season, the company uses three Bucyrus-Erie 8-yd. 190-B electric shovels.

The high output of the three Bucyrus-Erie Ward Leonard electric shovels keeps quarry production ahead of plant capacity . . . all season long. If sustained high output is essential to *your* operations, investigate this outstanding line of heavy-duty excavators.

127L57C



A Familiar Sign

**BUCYRUS
ERIE**

at the Scene of Progress

BUCYRUS-ERIE COMPANY • South Milwaukee, Wisconsin



EIMCO 40-H CONVEYOR LOADER



EIMCO 630 TRACTOR-LOADER



EIMCO 21 LOADER



EIMCO 12B LOADER

Crawler or Rail Mounted . . .

There's An Eimco Mucking Machine For Your Drift and Mining System

An Eimco 630 Tractor-Loader mucked inside an 18' circular shaft in Wyoming and a large rectangular shaft in West Virginia. On basis of its performance, it was publicized as follows: "This machine maneuvers well in confined space and readily loads into shaft buckets. It seems to offer many advantages in shaft mucking, loads faster than a clamshell and is safer to operate".

In Eastern U. S., an Eimco 21 rail-mounted loader was instrumental in the early completion of a 6250' x 8' diameter tube that will bring fresh off-shore water from a lake to city mains. It worked around the clock, tossing 30 yard rounds of rock (brought down 6 times every working day) over its back into 1 yard end-dump cars.

Operating in rock development work for a large German mining firm, 5 Eimco 40-H rail-

mounted conveyor loaders have driven 12½ miles with a combined downtime equivalent to less than two working days.

In England, rail-mounted 12 B's - Eimco's smallest mechanical loader - muck slate in a small diameter heading. The discovery: "Loading with Eimco 12 B's has many advantages over chute and grizzly system. It's faster, safer and more economical".

In mining and tunneling operations throughout the world, Eimco mucking machines continue to establish new production records under tough, grueling service.

There are many profitable reasons for specifying Eimcos when you buy your next mucking machines. And there's an Eimco type and size of mucker to meet your drift and mining system needs. Write today for full information.



B-280

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Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

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WELDING ROD CLINIC

J. Imperati and R. F. Pulver, Welding Engineers
The American Brass Company, Waterbury, Conn.

Braze Welding is virtually foolproof for cast iron repairs

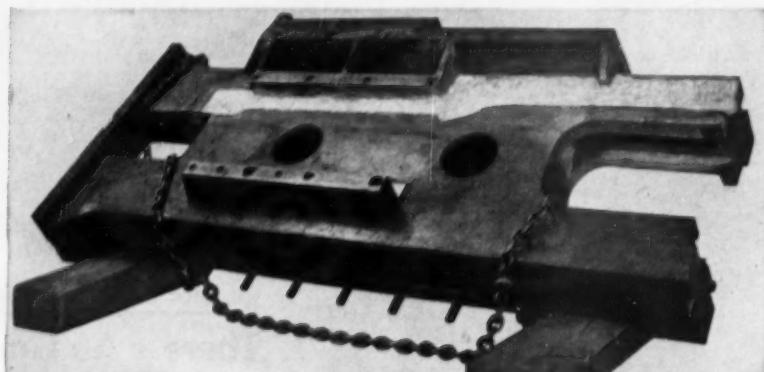
Low temperatures used give strong and enduring welds

The major obstacles to successful repair welding of cast iron are the low strength and poor ductility of cast iron weld metal, and the embrittlement and hardening produced by rapid cooling from welding temperatures.

Oxyacetylene fusion welds with cast iron rods have such very low strength and ductility that they often crack under the stresses imposed during welding and cooling. If they survive these hazards, they sometimes fail when subjected to the service stresses that caused the original failures.

On the other hand, severe embrittlement and hardening of weld and adjacent base metal are easily developed in arc welding because of the steep temperature gradients from weld to base metal. Here also, failure can occur during welding and cooling, or later in service. Usually the weld area is extremely hard and not machinable. It is often necessary to resort to extensive preheating, peening, post-heating, and annealing to avoid these twin evils.

Oxyacetylene braze welding is an excellent solution to the problem for two reasons. With the low temperatures required, there is no rapid cooling from high temperatures and therefore no embrittlement. Excellent ductility and high strength of the weld metal deposited by Tobin Bronze-481, Anaconda-997 (Low Fuming) Bronze, and Nickel Silver-828, permit yielding while the repairs are being made and after they are returned



A 7-foot fracture in this 6-ton press was repair welded in three days—20 hours preparation, 48 hours oxyacetylene welding time, using 400 lb. of Tobin Bronze-481 Welding Rod.

to service, and the danger of failure is practically eliminated.

The braze-welding operation itself is virtually foolproof because the molten bronze automatically "tins out" or spreads over the joint surfaces when the correct temperature is reached. Since the base metal is not melted, control of the weld metal is very easy. Braze welding is readily done in all positions.

ADVANTAGES OF BRAZE WELDING WITH ANACONDA RODS ARE:

1. **Economy in welding time** and gas consumption.
2. **Development of low residual stresses** with less distortion and less tendency to crack.
3. **No embrittlement**, and complete machinability of the weld areas.
4. **Minimum delay** in returning the repaired parts to service.

DETAILED INFORMATION AVAILABLE

Detailed suggestions on the methods of chipping grooves, removing oil, positioning the work, and preheating are given in Publication B-13. This 32-page book gives a complete description and full information on Anaconda Welding Rods and discusses procedures for welding with copper and copper alloys in a wide variety of applications.

These are some of the subjects covered: Copper-Alloy Welding Rods in steel sheet metal work, brazing and soldering, resistance welding, surfacing, welding copper alloys to steel, arc-welding of copper and copper alloys.

For information on special problems—or for a copy of Publication B-13—write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

87109A

| WELDING ROD | APPROX. COMPOSITION, % | APPROX. MELTING POINT | |
|-------------------------------------|---|-----------------------|----------------|
| Tobin Bronze-481 | 59 copper, 0.60 tin, 40.40 zinc | Deg. C 885 | Deg. F 1625 |
| Anaconda-997 (Low Fuming) Bronze | 57.80 copper, 40.27 zinc, 0.95 tin, 0.85 iron, 0.10 silicon and 0.03 man- ganese | 870 | 1598 |
| Nickel Silver-828 | 48.58 copper, 41 zinc, 10.25 nickel, 0.15 silicon, 0.02 phosphorus | 930 | 1706 |

ANACONDA®
WELDING RODS



Leo Garland and James Game, plant superintendent of Globe Fuel Products, stand by as Charles Kranson installs the valve on the steam line for test.

This Walworth Valve
came
“special delivery”

“When we get into a tough valve situation,” says James Game, plant superintendent of Globe Fuel Products, Inc. at Chicago, “we appreciate the personal interest that Walworth people show in our business.”

Mr. Game had a particular case in mind. Globe Fuel Products operates a fuel oil tank farm. Burning oils, in barges, are received at the dock. In order to reduce the oil viscosity to facilitate pumping, steam is piped, through flexible hose, to coils in the barges. Globe Fuel has standardized on Walworth 726F Iron body Wedge Gate valves as general-purpose valves handling burning oils as well as steam.

Mr. Game urgently needed a valve for this service, and contacted his local Walworth sales representative, Leo Garland, who arranged to have the needed valve delivered to the job by private automobile.

• • •

For almost every piping job there is a Walworth Valve. And, when special problems come up, Walworth distributors, salesmen, and engineers are ready to share their “know how” with you in arriving at the best practical solution. You can be sure their efforts will be marked by keen personal interest in your business.

WALWORTH

60 EAST 42nd STREET, NEW YORK 17, N.Y.

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SOUTHWEST FABRICATING & WELDING CO., INC. • M&H VALVE & FITTINGS CO. • WALWORTH COMPANY OF CANADA, LTD.



"41" SCRAPER HOIST

**DEPENDABILITY and
LOW COST operation
results in an
ORDER for 20 MORE!**



I-R CONSTRUCTION FEATURES GIVE DEFINITE ADVANTAGES

Handle Heavier Loads—

The "41" will handle scraper loads up to 9900 pounds

Faster Rope Speeds—

Rope speeds from 200 to 300 fpm. are available in 50, 60 and 75 hp. models.

More Profitable Operation—

Rugged design and construction, holds expensive downtime to an absolute minimum

Greater Safety, Easier Operation—

New features of the "41" are designed to minimize operator fatigue and promote maximum safety of operation.

You can't ask for more convincing approval than this: A large company, already using a number of Ingersoll-Rand "41" Scraper Hoists, opened a new property. They promptly ordered twenty new hoists of the same type. Their reasons: complete dependability, minimum maintenance . . .

Write today for information on operational data and exclusive Ingersoll-Rand features. Ask for Bulletin 5189.

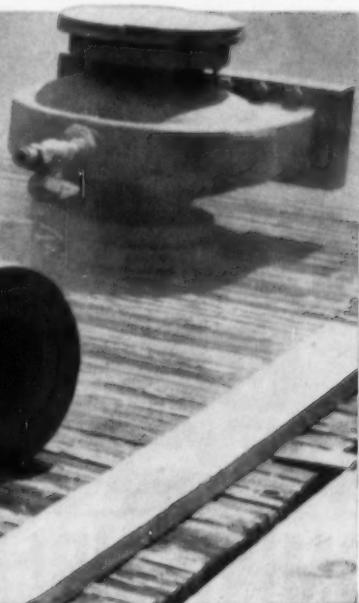
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11 Broadway, New York 4, N.Y.



BLAST!

... hundreds of hours longer
with NORBIDE®
Pressure Blast Nozzles



NORTON®

BORON CARBIDE

Making better products...
to make your products better

NORTON PRODUCTS
Refractories • Abrasives
Grinding Wheels • Grinding Machines
BEHR-MANNING DIVISION
Coated Abrasives • Sharpening Stones
Behr-cat Tapes

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VIEW OF SEYMOUR NARROWS

The shoal waters of Ripple Rock in Seymour Narrows were noted as long ago as 1792 when Captain George Vancouver made his famed exploratory journey. The shoals, in combination with a rip tide that boils through the narrow strait twice daily, has, in the last 80 years, sunk or damaged 114 vessels and brought death to more than 100 seamen. Swirls and eddies in the seemingly placid waters mark the twin peaks of a subaqueous rock projection by which coastal shipping must warily creep, taking advantage of slack tides.

BIG BLAST AT RIPPLE ROCK

750 Tons of High Explosives Will Remove Twin
Shipping Hazards at Seymour Narrows

J. P. Smallwood

EARLY in 1958, the legendary thunderbird, whose lair is in the mountains of British Columbia, will turn green with envy as the shock of one of the heaviest blasts ever to be set off by man will invade its snow-capped domain.

This event will mark the end of a 3-year job to pull the fangs of Ripple Rock, a treacherous, tide-lashed shoal in Seymour Narrows in the strait of Georgia between Vancouver Island and the British Columbia mainland. In the last 80 years the rock has sunk or severely damaged 114 vessels, large and small, with the loss of more than 100 lives. The

BASE CAMP AND HEADFRAME

The base camp on Maud Island, shown in these photographs, was established late in 1955. The camp site is the jumping-off point for a crew of hard-rock miners that hope to remove shoals in the heavily traveled passage between Vancouver Island and the British Columbia mainland. The headframe sits atop a 550-foot-deep, 3-compartment shaft, from the foot of which a 2370-foot-long tunnel has been turned.



blast is to be the culmination of an effort to reduce Ripple Rock to a depth of about 40 feet below the low-water mark.

At present ships must wait for slack tides at each end of the Narrows. Then, in a steady stream, they dart through from each end, risking collision in the restricted passage. Some 2000 large steamers as well as about 7000 smaller vessels use the pass annually and carry cargo valued at more than \$20 million. The total tonnage of the ships is estimated at about 3,000,000.

The treachery of Ripple Rock is based on the changing tides that twice daily boil through the Narrows causing the

formation of giant whirlpools, 40 feet in diameter, that can suck down small craft and push even the largest off course. The maelstrom of counter-currents continually threatening to bash the vessels against the twin pinnacles of stone that make up the Ripple Rock shoal has brought many gray hairs to the heads of pilots on the inland passage.

The first group action aiming at the removal of Ripple Rock was in 1921 and took the form of a petition to the Federal Government by the Canadian Merchant Service Guild whose members, representing 90 percent of the masters and mates in coastal shipping, had become alarmed by the mounting toll of ships and men. No direct action resulted however, and in 1930 another petition was presented to the Ottawa government by the Guild. This time the organization was supported by a great many other firms and groups affected by the hazard. A third petition presented in 1936, and another in 1942, finally brought about a decision to go to work.

Equipment for the first attack consisted of a drill boat equipped with 125-ton concrete anchors attached at each corner and in the center by 1 1/4-inch steel cables. To make a long story short, it didn't work. The barge bobbed around like a chip, and the cables snapped; drill holes were lost after penetrating only a few inches, and a whole summer's work proved ineffective. Ripple Rock, long a rankling thorn in the sides of shippers,

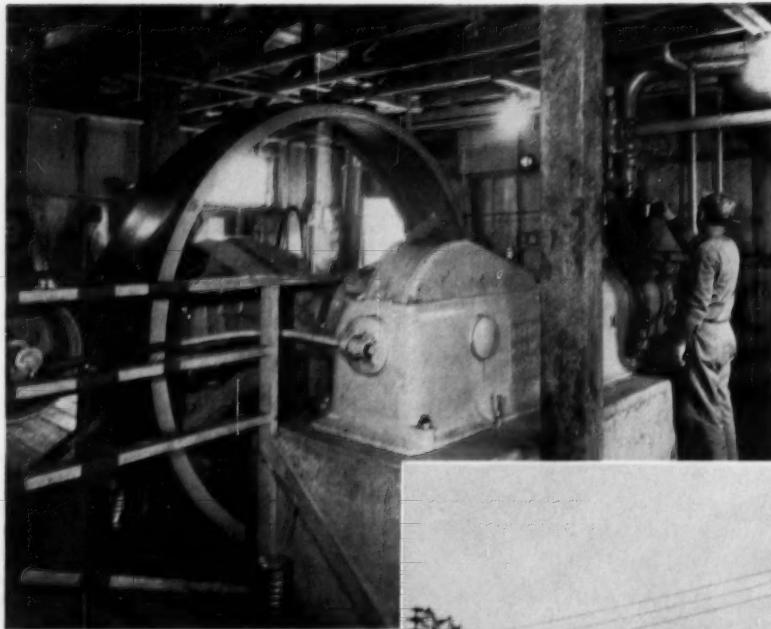
then became a formidable problem to demolition experts. Still convinced that the best method of attack was from the surface, a second attempt was launched in 1945. A drill barge anchored to the shore by two 3200-foot-long steel cables was tried. Each cable had a test breaking strength of 145 tons and was floated in raised position by fifteen 2-drum floats. Still the raging waters made effective drilling impossible, and this attempt was abandoned. Ripple Rock remained, relentlessly taking its toll and always the subject of heated discussions. Out of these emerged the growing conviction that the proper—perhaps even the only—method of attack was from mine workings beneath the bed of the channel and within the rock itself.

Finally in 1953, the National Research Council authorized a study that included an exploratory diamond drill hole from Maud Island on the east side of the Narrows, curving down under the east channel to a point beneath Ripple Rock. The idea was to determine whether or not the rock structure was solid enough to make this underwater approach practical. The diamond-core-hole contract was let to Boyles Brothers Drilling Company, Vancouver, B.C., and the hole was collared on August 31, 1953, at an angle of minus 34 degrees. Later a second start was made at a flatter angle of 22 degrees to be sure of achieving the curve specified in the contract. With the use of deflecting wedges to direct the hole as required, the contract was completed—the hole was bottomed at a distance of 2504 feet, after curving 8 degrees above horizontal. The Boyles Company designed and made their own equipment for that contract.

The long core hole proved the feasibility of an underground attack, and the job was turned over to the Department of Public Works. Dr. Victor Dolmage, consulting geologist, and E. E. Mason, consulting mining engineer, both of Vancouver, were employed to prepare detailed plans, collaborating with Dr. J. P. Carriere, Chief Engineer, Harbours & Rivers Branch, Department of Public Works.

The Vancouver firm, consisting of Northern Construction Company; J.W. Stewart, Limited; and Boyles Brothers Drilling Company, was awarded the contract on a bid of \$2,639,878. A base camp was established on Quadra Island in November 1955. The first step was to sink a 3-compartment shaft on Maud Island. It is 550 feet deep and 7x18 feet in cross section. One compartment is for service, one for mucking and the third serves as a manway. Sinking was done with Ingersoll-Rand Jackhammers. An ancient I-R air-driven plunger-type pump, still serviceable after years of operation, was used to dewater the workings.

From a point near the bottom of the



COMPRESSED AIR SUPPLY

The main air supply for the project is furnished by an Ingersoll-Rand Imperial Type 10 compressor (above) delivering 1000 cfm at a nominal pressure of 100 psi. It discharges through an I-R PL (pipeline) aftercooler to a receiver located just outside the building. The latter is visible behind the Ingersoll-Rand Gyro-Flo (rotary) portable compressor shown at the right which is the standby air supply for the Ripple Rock workings. At the left of the illustration, just across the small inlet, can be seen the headframe over the access shaft.



shaft a 2370-foot-long tunnel has been driven under the floor of the channel. At no point is it less than 100 feet below the channel bed. This bore, 6x7 feet in cross section, extends to a point under Ripple Rock. From there, two main access raises, 7x15 feet in cross section, are being driven and will lead up into the twin Ripple Rock pinnacles, reaching a height above the tunnel of about 300 feet. They also will be of 3-compartment construction and are to be served by Canadian Ingersoll-Rand Company 25-hp electric hoists. The latter will serve to haul men and material, particularly the 1,500,000 pounds of high explosive with which to load the coyote holes. The raises follow diamond-core explora-

VANCOUVER-ISLAND,

CAPTAIN George Vancouver was one of eighteenth century England's hardy sea rovers and explorers. The journey during which he visited the island bearing his name and explored the northern coast of North America began in 1791. From England, Vancouver's expedition sailed around the Cape of Good Hope to Australia, thence to New Zealand, to Tahiti, to the Hawaiian Islands and then to North America. His first landfall on the American coast was in the vicinity of what is now Ft. Bragg, Calif. His latitude reckoning at that point was $39^{\circ} 27'$, and he explored in minute detail the entire coast north to latitude $52^{\circ} 18'$ —just reaching the southern tip of the Queen Charlotte Islands.

At that time he circumnavigated Van-

couver Island and noted the menace of the Ripple Rock shoals. He completed his initial survey of the area during the year 1792, returning then to the Hawaiian Islands. He resumed his exploration of American coastal waters in April of 1793, carrying his party to a latitude of 56° , some 35 miles north of what is now Ketchikan, Alaska. Returning south, he continued the survey to 35° N—about 70 miles above Los Angeles, Calif.

Returning in January of 1794 to the Hawaiian Islands, he officially accepted, in behalf of Great Britain, the submission of the islands to the British Empire. His annexation was never officially ratified by his country however, thus leaving the islands free to later become a United States territory. He returned for the

third time to the American coast, resurveying the waters north of San Francisco, Calif., and finally returned to England in 1795.

The island which was named for Captain George Vancouver is the largest of an archipelago fringing the Pacific coast of Canada. It is the largest island on the west coast of North America and is part of the province of British Columbia. The archipelago is formed by the peaks of a subaqueous mountain chain paralleling the British Columbia coast. The terrain is generally precipitous and is broken by a great number of inlets and bays formed by the transverse valleys of the mountains. More than 250 miles long and about 80 miles across at its widest point, Vancouver Island is covered with

atory holes; when they are complete, the hoist rooms at the top will be hollowed out, and the hoists installed. Radiating into the rock from each raise, 6x7-foot tunnels will serve as lengthwise sublevels and will have an aggregate length of 380 feet. From the sub-levels, smaller 6x6-foot bores will be driven on a 45 degree slope. Then coyote tunnels will be punched out, honeycombing the twin peaks and providing chambers into which 750 tons of explosives will be loaded for the final blast.

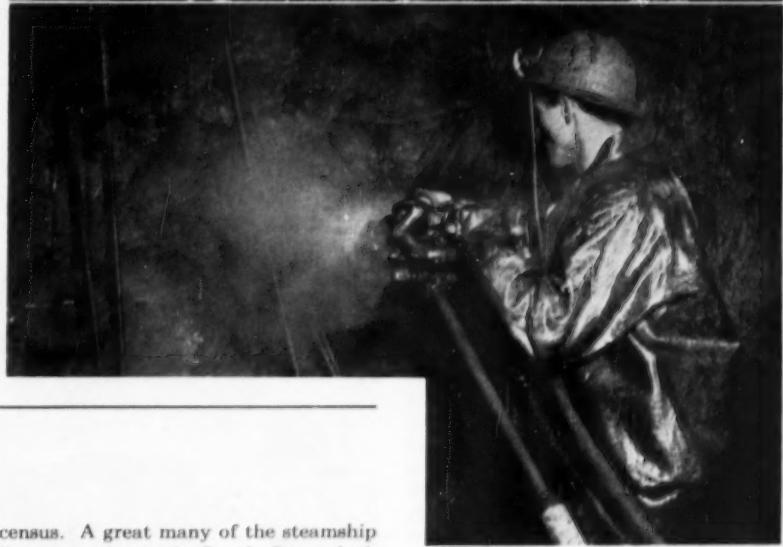
Prior to setting off the demolition charges, all people within a 2-mile radius will be evacuated. Before-and-after photographs will be taken of all existing structures; and the blast, fired with special timing calculated to minimize killing fish. The earth tremor will be seismographed and other instruments utilized to measure the power and extent of the devastating charge. Although the contract calls for lowering the Ripple Rock peaks to a depth of 40 feet below low water, engineers anticipate that 75 feet or more might disappear from the twin shoals.

Everything possible is being done to make Ripple Rock a safe job. All tunneling is preceded by a diamond drill hole to test for water, and grouting and/or timbering is ordered wherever there is an indication that such measures might prevent a cave-in or influx of water. Two Canadian I-R GSS grout pumps are installed in the workings to handle sealing tasks. Flood control gates and emergency doors are in use to provide a safe escape of the crews if the waters of Seymour Narrows should burst through in some unpredictable manner. Fresh air is provided by forced ventilation.

A 13,000-volt British Columbia Power Commission high line to power equipment in the workings was strung from Duncan Bay, north of Cambell River, to

Menzies Bay on Vancouver Island. Because it involved a 3000-foot-long overhead span to Maud Island, it was no mean engineering feat in itself.

The project manager for the Ripple Rock job is Col. C.B. North; W.J. "Bill" Grieve is project superintendent; C. Phillips, master mechanic; and L. Atkins, office manager. A.F. Seraphim acts as over-all supervisor for the Northern Construction Company and J.W. Stewart, Limited.



MAN AND CITY

immense stands of timber, that being one of its chief products. Extensive coal and iron deposits, some copper-bearing ores of commercial value and extensive fisheries make up the remainder of its resources. The climate, considering latitude, is extremely mild—all the fruits of the temperate zone flourish in the southern lands, as well as the grain cereals and pasture grasses.

The City of Vancouver is gifted with what is said to be one of the finest natural harbors in the world. Its real growth dates from the completion, in 1885, of the Canadian Pacific Railway, for which it is the western terminus. Situated on the south side of the Burrard inlet, the city is Canada's third largest, having a population of about 345,000 in the 1951

census. A great many of the steamship lines operating in the Pacific Ocean dock at Vancouver, and its grain handling facilities are among the largest in the world. Many of the rich agricultural products of the fields of British Columbia and Alberta go through its port on the way to world markets. In addition, almost all of the vessels plying the coastal waters of North America make stops at the Port of Vancouver.

The virtual inland waterway between the islands and the mainland is a favored passage for coastal vessels, and it is between the island of Vancouver, near its wide, central bulge, and the British Columbia mainland that the twin peaks of Ripple Rock rise to interfere with the marine trade.

DRILLING SCENES

Tri-purpose drills are in use on the Ripple Rock project. Ingersoll-Rand IR-38 Universal Jackdrills were used to sink the 550-foot-deep shaft on Maud Island. The same machines later were equipped with air-feed legs to drive the tunnel under Seymour Narrows and, because they can readily be converted for stoping use, are also being used to raise the access slopes into Ripple Rock itself. Three of the drills are shown in the illustration at the top, working in the 6x7-foot access bore under the Narrows. Another is shown at the bottom. The machines are drilling wet, and the tunnel is force ventilated. A diamond core-drill hole is carried well in advance of the tunnel face to test for water.

Oil Flows in the Sahara

Rock Drills Find Important Role In Seismic Investigations of Desert Lands



DRILLING RIGS

The illustration at the right shows one of the special drill rigs in operation. The supplementary air filters that aid in protecting the compressor from desert dust are visible. At the top the tubular frame and tower are shown tilted forward for a long distance move. The steel platform built out over the wheels helps protect the compressor from sand.

RECENT discoveries of important oil deposits in the Sahara Desert have brought world attention to this vast, little-known territory that comprises the greater part of North Africa. The barren wasteland that for centuries has grudgingly yielded a meager livelihood to wandering desert tribesmen is now thought to possess oil reserves potentially as great as those of the State of Texas.

The physical boundaries of the Sahara are vague and disputed, but the total area is estimated to be 3½ million square miles, or about the same as that of Europe without Scandinavia. The greatest length, along latitude 20° N., is 3200 miles; the width from north to south varies from 800 to 1400 miles. The French Sahara (exclusive of the desert areas in Morocco, Tunisia and Libya)

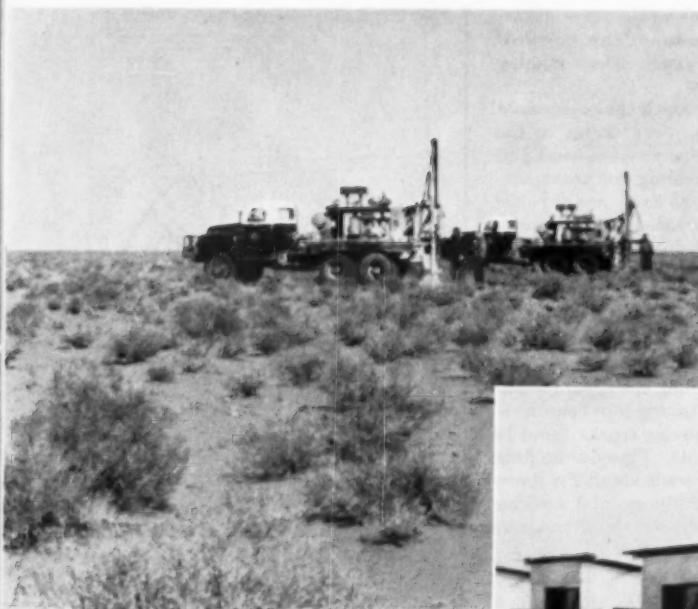
has an area of 1½ million square miles and a population of about 2 million.

For the most part the Sahara is a succession of plateaus, some covered by sand dunes called "erg." However, not all of the desert is sand; much of it is a gravel residual, called "homeda" or "hammada," that remains when soil blows away. It supports a very limited amount of vegetation including varieties of acacia bushes and tough grasses. Al-



though in some areas during the day the temperature goes beyond 140°F, it is not always hot throughout the desert. In the higher plateaus, it often is cool enough for heavy clothing.

Many theories have been advanced to explain present climatic and soil conditions of the desert. A marine or sea encroachment explanation, once quite generally held, is now considered untenable; desert sand is identified with the



DRILLS ON LOCATION

The picture above shows three mobile drill rigs on location near Laghouat, Algeria. Seismic prospecting is the most common exploratory method used in the Sahara. A number of shallow holes are fired in preference to fewer, larger diameter and deeper ones holding larger charges of explosives.



PERSONNEL HOUSING

The huts shown in this picture are provided for the drilling crews by the contractors. Such camps as these are protected from the attacks of marauding rebels by contingents of the famed French Foreign Legion. This site is near Tidremp, Central Algeria. Contrary to popular concepts, some parts of the Sahara are cold enough to require heavy clothes and some protection from the weather.

Quaternary period, and there is no evidence of marine transgression in the area since pre-Tertiary times. It is now generally assumed that the soil lost its moisture as prevailing winds became dry when changed meteorological conditions followed the retreat of glacial ice from central Europe.

SAHARA OIL SEARCH

The French have been systematically prospecting for oil in the Sahara since 1945 without, however, making headline news until recently when discoveries indicated substantial reserves in two fields. The first of these is at Edjele, in the eastern part of the desert near the Libyan border. Here, after various findings of gas, oil was discovered in important quantities during 1956. More recently, another apparently huge deposit of oil has been found in the northeastern Sahara near Ouargla, about 350 miles from the Mediterranean coast. The oil here was located at a greater depth than at Edjele, and the field is thought to be more extensive.

Estimates of the total reserves in these fields vary widely. It is reported that the first well of the Ouargla field produces about 2500 barrels of oil daily, and that the total reserves of this field are 7 billion barrels. As an interesting historical note, the first crude produced in the African desert arrived in France in the early part of May, 1957, when the tanker *Rousard*

docked at Le Havre carrying 16,000 tons of oil.

Four companies have been granted research permits in the French Sahara, and all are actively engaged in exploration over wide areas. Two of these have already struck oil. The Edjele field was bought in by Compagnie de Recherches et d'Exploitation des Petroles au Sahara (CREPS), a joint venture of the French Government and the Royal Dutch Shell Group. The Ouargla field was discovered by Societe de Recherches et d'Exploitation de Petrole en Algerie (S.N. REPAL). The other two companies are Compagnie Francaise des Petroles (Algerie) [C.F.P.(A)], and Compagnie de Petroles d'Algerie (C.P.A.). The latter are both privately owned concerns, and in view of the recent successes in the area, are considered to have excellent prospects for discovering oil. All four concerns utilize various exploration, drilling and research firms.

One of the principal methods being used to locate oil is seismic prospecting, and a brief discussion of this technique is included elsewhere in this article.

It was customary a few years ago for drilling crews in the Sahara to place large amounts of dynamite at the bottom of 4 3/4-inch diameter holes from 100 to 400 feet deep. This method of shooting profiles was unsuccessful, however, and was discontinued when better results were obtained by drilling a number of shallow, small-diameter holes grouped in patterns spaced from 300 to 800 yards along profile lines. These holes are usually 6 to 10 feet deep with diameters of 2 inches or less. Most of the seismic exploration in the Sahara is now being done in this manner.

The problems encountered in drilling in the Sahara are varied. The very wide expanse of territory to be covered, the climatic conditions and the presence of roving bands of rebels have all made progress difficult. All equipment is truck mounted to provide mobility. Most drilling crews work at considerable distances from the main camps, which are protected by French troops. They need equipment capable of drilling at great speed, but light enough to keep transportation costs down. The equipment

must be easily interchangeable so that it can be shifted from truck to truck in case of breakdowns, and sturdy enough to stand up under severe operating conditions.

One of the contractors employed by S.N. REPAL, for example, uses International Harvester trucks, on each of which is mounted an Ingersoll-Rand (Cie Ingersoll-Rand, Paris) 315-cfm Gyro-Flo (rotary) compressor and an I-R wagon drill. The trucks were fitted out in Algiers especially for Sahara service. An Air-Maze oil-bath intake filter is standard equipment on the Gyro-Flo units and serves both the compressor and engine, but as additional protection against the desert sand, each has a pre-cleaner filter.

The wagon drill is mounted on a feed chain tower, which is in turn, mounted on a cross bar on the tubular frame by means of a sliding cone-and-clamp. This allows the drill to be placed in any position. At the base is an efficient steel cen-

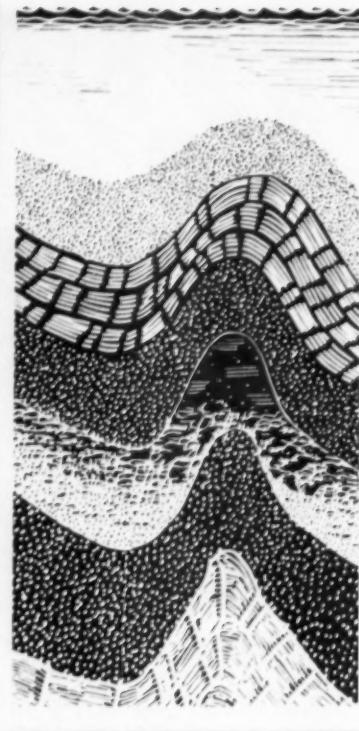
tralizer that guides the bit when collaring the hole. The tower can be tilted forward over the truck when making long distance moves.

The platform on which the compressor is mounted permits easy access to the machine and protects it from sand and dust during both drilling and transporting. It also serves to carry spare parts, additional bits and tools. A water tank is located directly behind the cab for wet drilling when it is necessary.

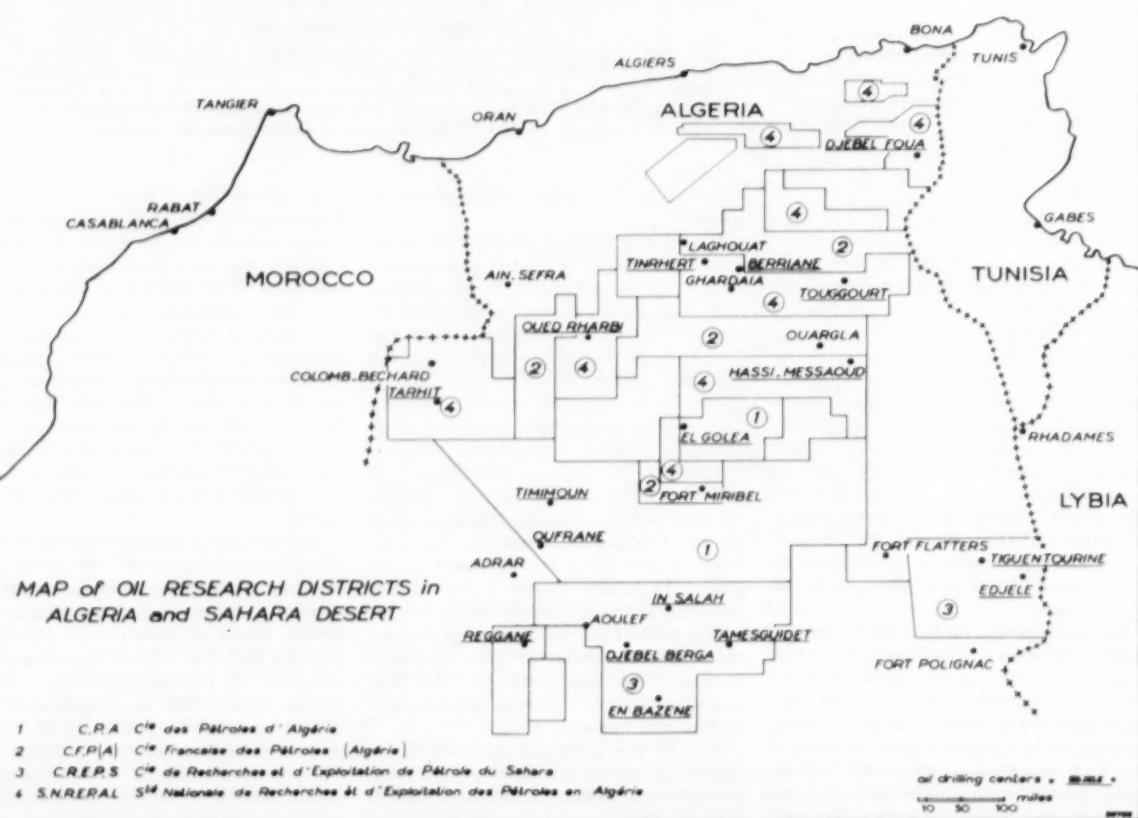
During performance tests, one of the drills, using Ingersoll-Rand Carset (carbide insert) Jackbits, had an average penetration rate of 330 feet per hour. Actual over-all drilling speeds are about 260 feet per hour, taking into consideration lost time for moving trucks about 16 feet from hole to hole. Travel time from base to job and return is about 2½ hours per day, so that in the normal working period of 5 to 5½ hours, the three units on the job are able to complete about 3½ miles of straight line profile drilling.

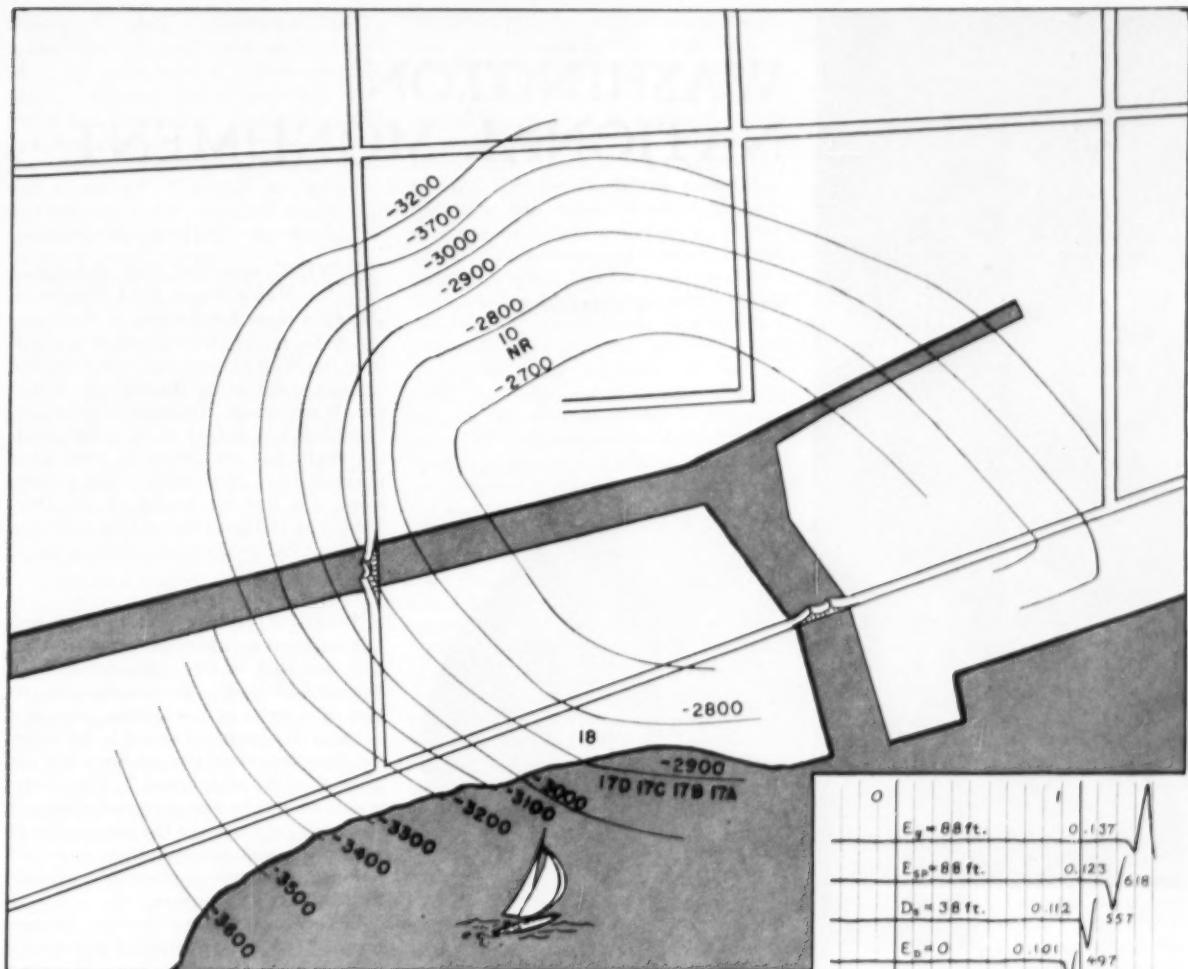
LOCATION MAP

The map below shows the areas of the Sahara that are being explored for oil; the legend indicates the four companies permitted to carry out exploratory operations. The recently discovered fields are at Hassi Messaoud and Edjele. Full utilization of the latter will require the construction of pipelines either to the Mediterranean or to railheads in North Algeria.



MEDITERRANEAN SEA





CHART, SEISMIC PROSPECTING FOR OIL.
C. HEWITT DIX, HARPER & BROTHERS PUBLISHERS

THE SEISMIC EXPLORATION METHOD

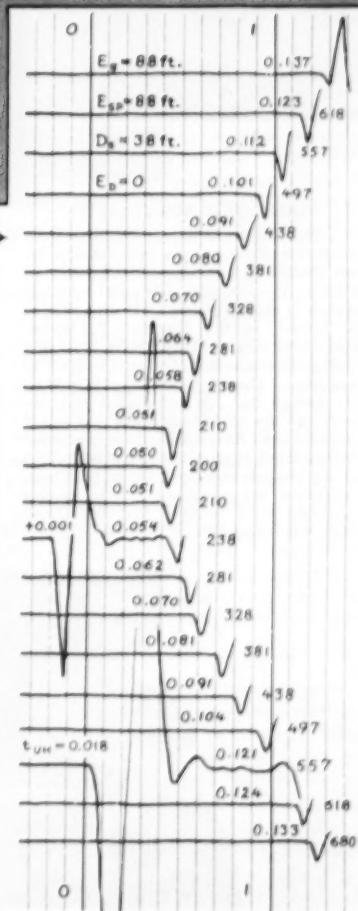
THE geological structure of underground rock formations is a fundamental concern of oil prospectors. The seismic method is one of many that has been developed to determine such structures.

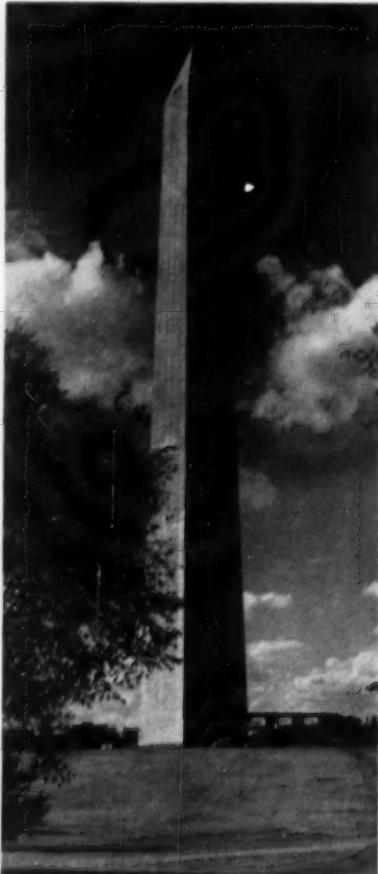
Oil prospecting by the seismic reflection method begins with the selection of the area to be explored. Because of the cost of seismic exploration, this is usually done by geological survey, core drilling, aerial photo survey or some other means. When the area to be explored has been designated to the crew, the surveyor examines the area and selects seismograph locations. "Shot" holes are then drilled, varying from several to several hundred feet in depth, and up to 6 inches in diameter. Explosives are placed at the bottom of the holes and, at the direction of the instrument operator who takes the seismic record, are fired.

The echoes, or pulses, of the shots

travel to rock structures below and are reflected back to the surface. They are picked up by mechanical ears, transmitted to a central location and converted into wavy lines on a seismograph tape. The deeper the contacts, the longer the time required for the seismic pulses to return to the instruments that detect, time and record them. The velocity of pulse travel can be obtained and the distance traveled can be computed from the measured time recorded. These distances form the basis of the interpretations made by seismic explorers of the geological structures beneath the surface.

A typical, oil-bearing, underground structure is shown on the preceding page (top). The record at the right is typical of those obtained on seismograph tapes, while discovery maps similar to the one at the top are prepared from such records of shot reflections.





PHOTO, ABBIE ROWE,
NATIONAL PARK SERVICE

WASHINGTON NATIONAL MONUMENT

S. M. PARKHILL

LYING near the spot designated by Major Pierre C. L'Enfant in the plans for the city of Washington, D.C., at the cross axis running south from the White House and west from the Capitol, dominating the skyline, stands the Washington National Monument. Dignified and devoid of embellishment, the shaft was completed in 1884 after years of delay and debate. The cornerstone was laid on Independence Day, 1848, with the same trowel that had been used in 1793 to place the cornerstone of the Capitol.

GENERAL George Washington had acquired considerable fame by 1783 and was held in high admiration. On August 7 of that year, Congress, in the first of a series of resolutions, proposed to build an equestrian statue in his honor "at the place where the residence of Congress shall be established." Above the statue were to be placed reproductions of the principal events of the Revolution of 1776. Although the intentions were well founded, Congress neglected to provide for the erection expenses.

Sixteen years passed and on December 23, 1809, 8 days after the president's death, John Marshall (later Supreme Court Justice) moved that Congress build a monument and request the family survivors to permit his body to be deposited under it. A year later, Congress

PROPOSED MONUMENT

In 1836, Robert Mills, an architect from South Carolina, won a competition for the design of a monument in honor of George Washington. His prize-winning sketch is shown at the right and was to be known as the National Pantheon. The lower structure was to be 250 feet in diameter and the shaft was to be 600 feet high. Due to financial difficulties, the design was not completed as planned, and the colonnade base was never constructed. As a result of a subsequent engineering survey, the planned height of the obelisk was reduced to 555 feet, including the capstone. It is in this modified form (above) that the Doric shaft was completed.



resolved to build a granite-and-marble mausoleum-type structure in the shape of a pyramid with a 100-foot-square base. Although the present-day spire shows no resemblance to the proposed pyramid, it was with this resolution that the Washington National Monument was conceived. The plan was adopted by the lower house, and a bill was passed appropriating \$200,000; however, the Senate did not concur.

The matter did not represent itself with any seriousness until 1816 when Virginia made an effort to move the general's remains to Richmond. Both the ambitions of the State and Congress were blocked by Bushrod Washington, nephew of the general and then owner of Mount Vernon, the Washingtons' home- stead. He refused on the grounds that the president had wished to be buried at his home. Again in 1832, the request was denied, this time by John A. Washington, possessor of the property.

Undaunted, and at the persistance of Henry Clay, a neoclassical statue of General Washington was approved. Executed over an 8-year period by Horatio Greenough, it depicted the president in a Roman toga. When finished in 1840, the 20-ton sculpture was placed in the rotunda of the Capitol. Because it was too heavy for the floor, it was subsequently moved to the plaza in front of the building, and in 1908, to the National Museum where it stands today.

In 1853, Congress provided for the execution of the first resolution (1783) by appropriating \$50,000 for the equestrian statue. Clark Mills, who had proved his skill with a sculpture of Andrew Jackson, was selected as the artist. A distinguished gathering at the unveiling ceremony 7 years later saw General Washington in the uniform of the Continental Army's Commander in

Chief rallying his shaken troops on the line at the Battle of Princeton, N.J.

Although two statues had been erected, nothing was done about the 1800 resolution to build a mausoleum-type memorial. Deep disappointment felt by civic-minded citizens was magnified by the fact that by the 1830's, many communities had either planned or constructed their own monuments. Robert Mills, for example, an architect from South Carolina, had won a competition in Baltimore, Md., by designing a simple 204-foot-high Doric shaft. The required \$150,000 to erect the structure was raised by public subscription and by 1829, the work was finished. This, in conjunction with the rivalry between the cities of Washington and Baltimore, proved to be the final stroke. In 1833, a Washington National Monument Society was formed in the District of Columbia with a single aim of building a suitable monument in the Nation's capital. The first president of the group was Chief Justice Marshall. James Madison succeeded him in 1835, and it was under his direction that a systematic collection of money began.

Contributions were limited to \$1 per person per year, in that way assuring that the movement would be within the financial reach of all and of a truly popular national scope. Collection agents were appointed in all the states and territories, but money was given slowly. Because of the Panic of 1837, only \$30,000 had been raised by 1838.

During the interim before the panic, an architectural competition was opened, and again Robert Mills designed the winning plan. It called for a Doric obelisk similar to the Baltimore structure. It was to be 600 feet high and surrounded at the base by a circular pantheon-type building, 250 feet in diameter. Surmounted on the colonnaded structure was to be a colossal figure of Washington. Outside the rotunda, but under the colonnade, were to be statues of the signers of the Declaration of Independence and leaders in the revolutionary movement. Space was provided for paintings depicting scenes of the period. If the remains of Washington were ever permitted to be moved, an area was left under the tapering shaft

for a tomb. The entire structure was to be known as The National Pantheon.

From 1838 to 1845, public collections were so slow that the \$1 limitation was finally removed. Entertainments, during which vigorous efforts were made to encourage donations, brought the total contributions to only \$87,000. Nevertheless, the Washington National Monument Society felt that enough had been raised to start the project. On July 4, 1848, before a group of representatives of the diplomatic corps, the states and territories; members of congress and the cabinet; the supreme court; and the president, the cornerstone was laid.

For economical reasons the society was forced to modify Mill's original design by fixing the maximum height of the shaft at 500 feet and by holding the plans for the base and National Pantheon in abeyance. Work proceeded well for several years until the funds began to dwindle. The organization then encouraged states, municipalities and associations to contribute 4x2-foot stones. This proved popular, and eventually even Americans living in distant Foo- Chow-Foo, China, gave stones. The monument had reached the 153-foot point when a system of placing U.S. Post Office employees in charge of the collections was adopted. However, a series of events brought still another delay. Little additional money was collected after 1856. Someone stole a memorial stone sent by Pope Pius IX—the whereabouts of which and the identity of the thieves are still mysteries. This unfortunate affair, coupled with the growing disagreement between the North and the South, brought construction to a halt in 1861, almost 400 feet short of the goal.

Lt. W. L. Marshall of the U.S. Army Corps of Engineers reported, in May 1874, that it was "inadvisable to complete the Washington Monument to the full height The area covered by the foundation is too small for a structure of the proposed dimensions and weight, causing an excessive pressure upon a soil not wholly incompressible." He recommended that it be less than 500 feet.

As the centennial year of 1876 approached, patriotic feelings filled everyone. During this time, Congress too caught the spirit and appropriated money; and the following year the Society deeded the project to the Federal Government.

A BOARD of army engineers was appointed by Congress to investigate the soundness of the foundation. Many important features of the work performed in completing the monument emanated from suggestions made and worked out by a group headed by Lt. Col. T.L. Casey. As the work progressed, faithful performance on the part of contractors supplying material was closely



regulated. The immediate direction of the work and workmen on the grounds was the duty of P.H. McLaughlin, master mechanic. Bernard R. Green, a civil engineer, conceived and worked out the plans for placing the top pyramidion on the shaft. The detail plans for the construction were drawn by Gustav Friebus, an architect from Washington.

Because of the reportedly insufficient foundation, underpinning was necessary before construction continued. The original foundation was of blue gneiss rock, in large blocks as they came from the quarry, placed in lime mortar with some cement. It was of a stepped-pyramid shape, 80 feet square at the base, and covered an area of about 6400 square feet. The structure extended 7 feet 8 inches below, and 15 feet 8 inches above the ground. As strengthened and enlarged, the foundation is 126½ feet square and 36½ feet deep. It extends to a level 6 inches below that of the permanent water level at the site on which the monument is located.

According to the annual report of Col. Casey, the work of underpinning consisted of "digging away 70 percent of the earth underneath the old foundation and to a depth of 13 feet 6 inches beneath it, and replacing this earth with a mass of concrete, extending 18 feet within the

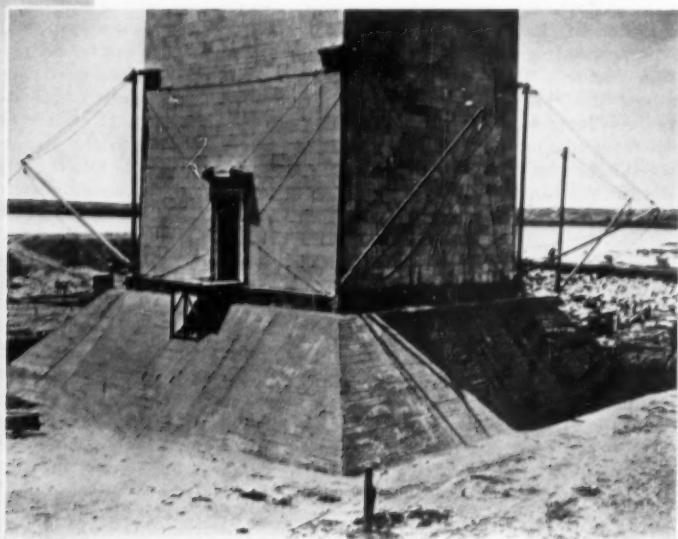
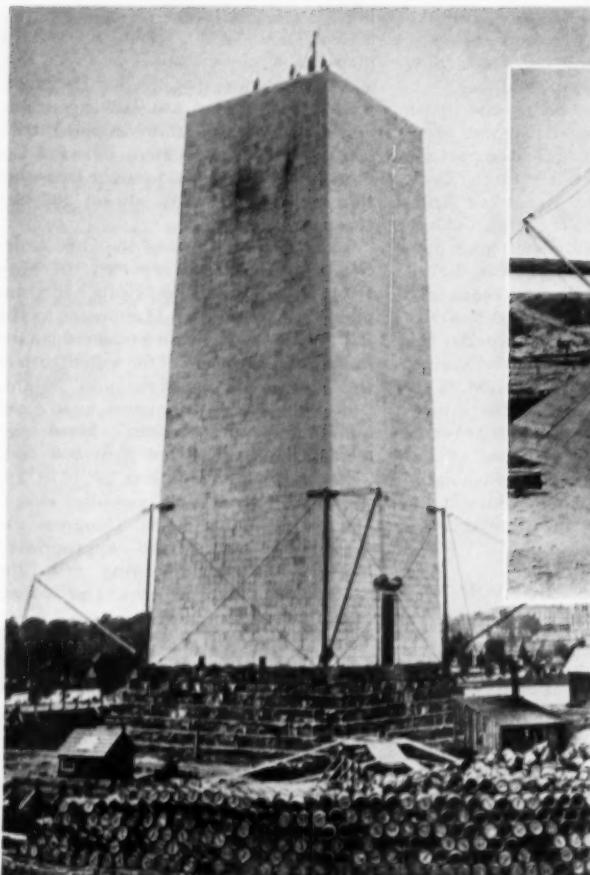
outer edges of the old foundation and 23 feet 3 inches without the same line. To distribute the pressure of the shaft over this new foundation, the old rubble-stone base was torn from under the walls of the shaft and replaced by a concrete underpinning extending out onto the new concrete slab. In this work, 51 percent of the cubical contents of the old foundation was removed and 48 percent of the area of the shaft undermined." The material used was a concrete mixture of one part portland cement, two parts sand, three parts pebbles and four parts broken stone. Before the material was approved, an 8-inch molded block was tested. It showed its first crack at a pressure of 105,000 pounds, while the maximum pressure fracturing it was about 122,000 pounds, or 1906 1/4 psi.

During the underpinning program, the monument showed an even settling of 2½ inches. (Throughout the entire construction, the monument settled only 4 inches.) The 81,120-ton weight of the structure is so well distributed that it is estimated that a 145-mile-per-hour wind would not topple it. A 30-mile-per-hour wind causes a sway of only 0.125 inch at the peak.

During this time, a deflection of 1.4 inches, which the unfinished shaft had toward the northwest due to past set-

ting, was corrected. The faces, being found not to align with the chief points of the compass, were given a slight twist during further construction so that they finally came to rest, in the upper portion of the monument, in the north-south and east-west planes.

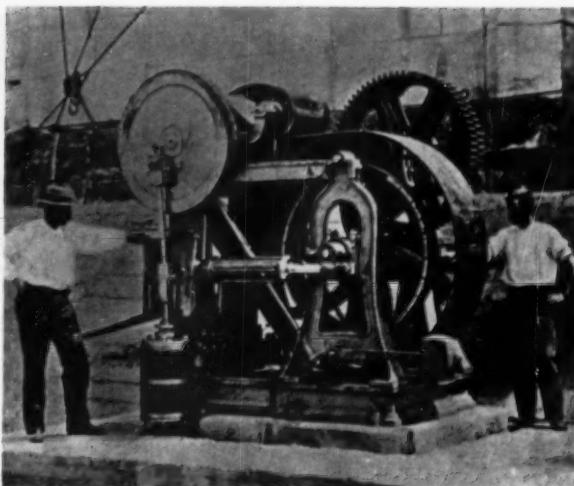
The plans of the obelisk were modified so that the proportions are in exact accordance with classic architecture of this design. These were determined after careful research by the Honorable G.P. Marsh, then American minister in Rome. The Washington National Monument was to be about 550 feet high, including the 50-foot cap. It was to be faced with white marble and backed with granite. With the exception of the first 26 feet of work, the marble for which came from Lee Marble Company of Massachusetts, all of the stone was brought from Baltimore County, Md. The base measures 55½ feet square on the outside; and 25 feet on the interior. The taper is about 1/8 inch per foot. There are 898 steps on the inside, with landings after every 10-foot flight. Here can be seen the 188 carved memorial stones, including ones from the Parthenon in Athens, the ruins at Carthage and the tomb of Napoleon at St. Helena. For the less energetic sightseer, an elevator, installed in 1926, can lift as many as 35 passengers to the



PHOTO, NATIONAL PARK SERVICE

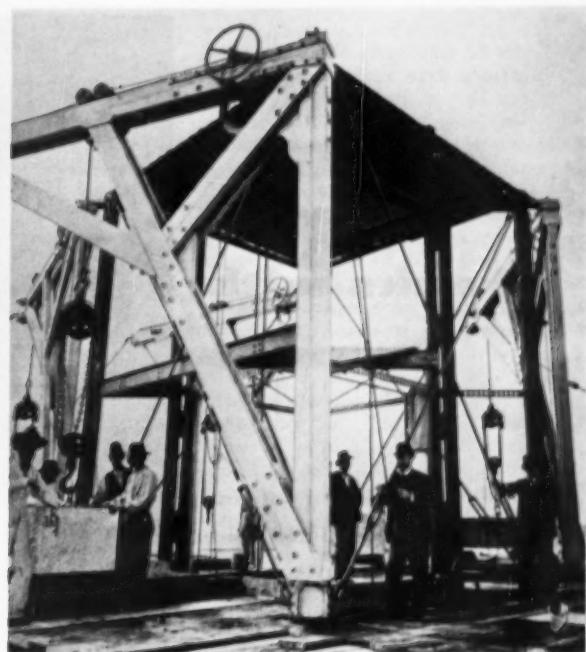
UNDERPINNING THE FOUNDATION

At the (left) can be seen the incompletely Washington National Monument as it looked in 1878. The original foundation is in a state of preparation for its enlargement. The view is toward the southeast corner. The underpinning was completed (above) in June of 1880, and work was resumed the following August. At this time, a second cornerstone was laid at the 150-foot mark.



CONSTRUCTION EQUIPMENT

Standing in a maze of supports, chains and pulleys (right), are men of the construction team. This was the equipment used for setting the stone in building the shaft of the Washington Monument. As the height increased, elevators were necessary. A steam hoist for one of these can be seen above.



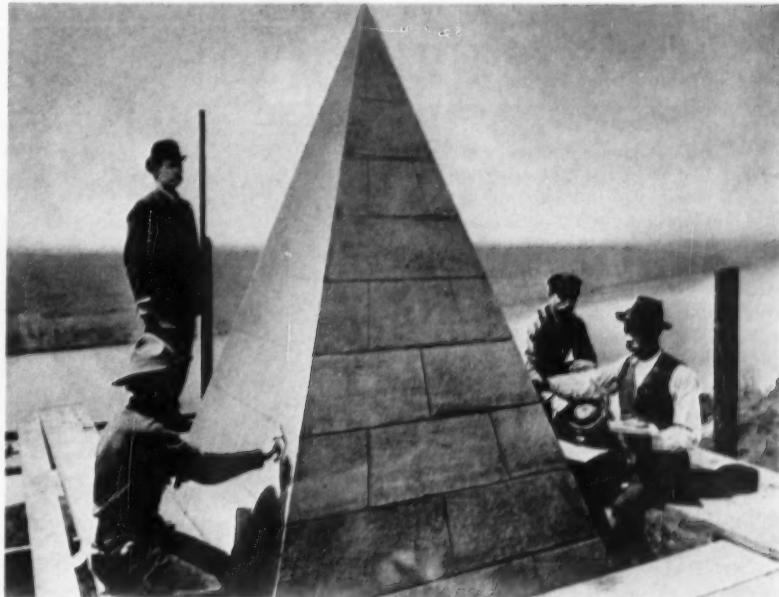
top in 70 seconds. From there can be seen the entire District of Columbia as well as many of the bordering sections.

Work was resumed on August 7, 1880, with the laying of a second cornerstone. The event was made the occasion of some ceremony. Colonel Casey, President and Mrs. Hayes, and dignitaries of the Washington National Monument Society and the engineering group participated. They ascended 150 feet to the top of the walls by an elevator. A bed of cement was prepared on the last course at the northeast corner. The stone was lifted by a derrick and moved into place, but before it was lowered and set, President Hayes stepped forward and placed in the cement a small coin on which his initials and the date were scratched. The rest of the party did likewise, and after watching the stone set, descended.

At this time a life net was positioned around the outer walls. It was used throughout the remaining construction and was moved upward as the work progressed. The safety device prevented serious accidents and loss of life. No deaths were reported, although there are several recorded falls into the net.

Four years later, on December 6, work was completed. At 2:00 p.m. the capstone was set while artillery pieces at the base fired a salute. Six hundred feet above the ground, high in the rigging, the national flag was unfurled. The following February the structure was dedicated; and October 9, 1888, it was opened to the public.

Of the total cost of nearly \$1,200,000, the Washington National Monument Society had raised and spent \$300,000 in building the original foundation and running the shaft 152 feet—a point 33



SETTING THE CAPSTONE

Although the structure was not opened to the public until October 9, 1888, the date the capstone was set was a memorable day for the members of the Washington National Monument Society, for with it, their dreams were fulfilled. The event took place at 2:00 p.m., December 6, 1884, with the thundering of artillery pieces at the base. The stone weighs 3300 pounds, and is crowned by a small, right pyramid of pure aluminum, 5.6 inches at the base and 9.8 inches high. It weighs 100 ounces, and at the time was the largest piece of this metal ever cast. It is interesting to note that according to the "Wall Street Journal," aluminum in the last century cost \$500 per pound. The price has dropped until it is now 26 cents for the same amount.

feet short of the one-third mark. Construction records for the last years show that during the 1880 working season, 26 feet were added to the shaft. During 1881, 74 feet more were built, 90 additional feet the following year, and 70 feet

in 1883. By August 9, 1884, the walls had reached the 500-foot mark. Including the capstone, the monument rises 555 feet 5 inches above its floor. When completed, it was the tallest piece of masonry in the world.

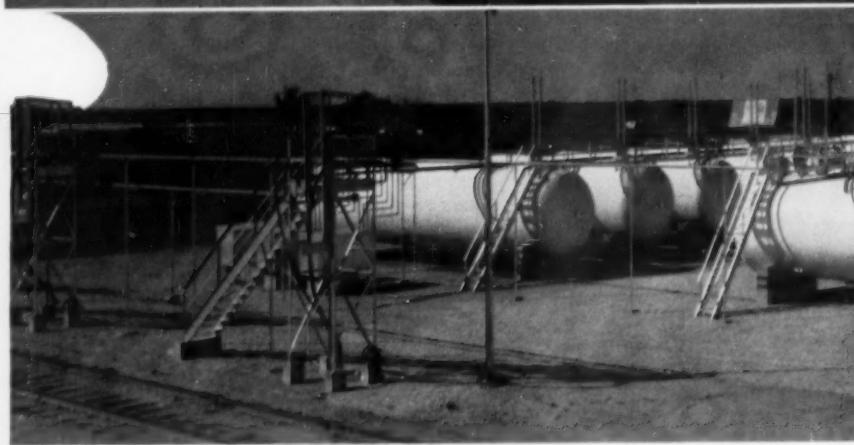
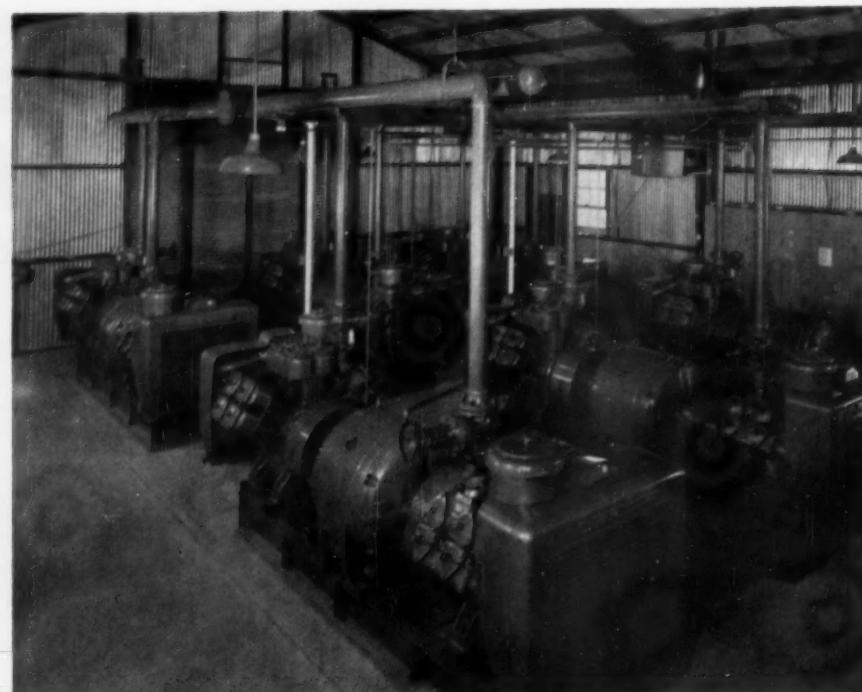
Shaving Peaks with Propane

Iowa Power & Light Company
Plant Has 18-Million-Cubic-Foot-Per-Day Capacity

B. F. AGUARD

NATURAL gas pipeline companies like to make the most efficient possible use of their facilities. This is difficult when a number of consumers on the line are drawing off the gas at will—on demand. If a user draws steadily without undue variations, the pipeline company can plan its deliveries and thus achieve certain operating efficiencies that keep costs and customer charges down. However, if a pipeline must undertake the supplying of all the gas needed by a consumer, no matter how greatly the demand varies, its own costs soar and consequently customer charges rise.

A utility that furnishes a city with gas must expect great fluctuations not only from season to season but even from day to day. It also wants to keep its costs for gas within reason by avoiding high pipeline charges or "demand rates." About the only way this can be accomplished and still meet customers' requirements is to provide standby supply facilities that can be called on during peak demand periods to make up the difference between what it can draw from the pipeline and what it must deliver. This deficit or "peak-shaving" supply can take many forms ranging from high-pressure natural gas storage to stand-by facilities for making manufactured gas. Another popular method of peak shaving is to provide storage facilities for liquefied petroleum gas (LPG) and means for mixing it with compressed air in such proportions that its physical and burn-



TANK FARM

Liquefied propane is stored in the thirty 30,000-gallon tanks shown in this over-all view of the IP&L plant, designed and built by Drake & Townsend, Inc. A portion of the 4-car unloading rack is visible alongside the spur line.

ing characteristics closely resemble those of natural gas.

Such an installation utilizing propane has proved very successful at the Des Moines plant of Iowa Power & Light Company. The IP&L facility has a daily (24-hour) capacity of 18 million cubic feet of propane-air gas at 125-psig pressure. This is about 18,700,000 cubic feet at 14.65 psia, the pressure at which it is delivered to consumers.

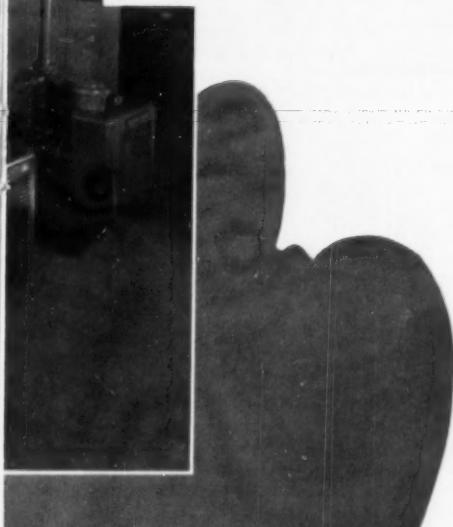
Designed and erected by Draketown (Drake & Townsend, Inc.), the original specifications called for a plant providing 500,000 cubic feet per hour (12 million cubic feet per day). This was completed in November 1955, and consisted of fif-

teen 30,000-gallon-capacity storage tanks, four Ingersoll-Rand 250-hp Type 40 double-end compressor units (four pairs of compressors, each driven by a 250-hp motor), two 125-hp Superior automatic steam boilers that supply heat to vaporize the propane and two 4000-gph Draketown vaporizers. Three tank-car unloading stations were erected beside a spur line on the property, and LPG compressors have been installed to unload them by the vapor-transfer method.

Increased demand soon required an increase of 50 percent in the capacity of the plant and these additions were completed in October 1956. Two more Inger-

COMPRESSOR LAYOUT

The installed horsepower in the compressor plant of the Iowa Power & Light Company propane peak-shaving plant at Des Moines totals 1500. The units discharge to two Ingersoll-Rand vertical receivers located outside the building. Discharge pressure of the units is very closely controlled within a range of 3-5 psi of the required 125 psi.



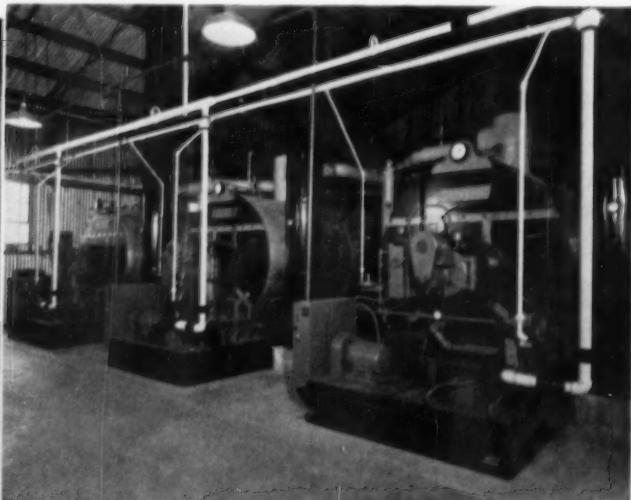
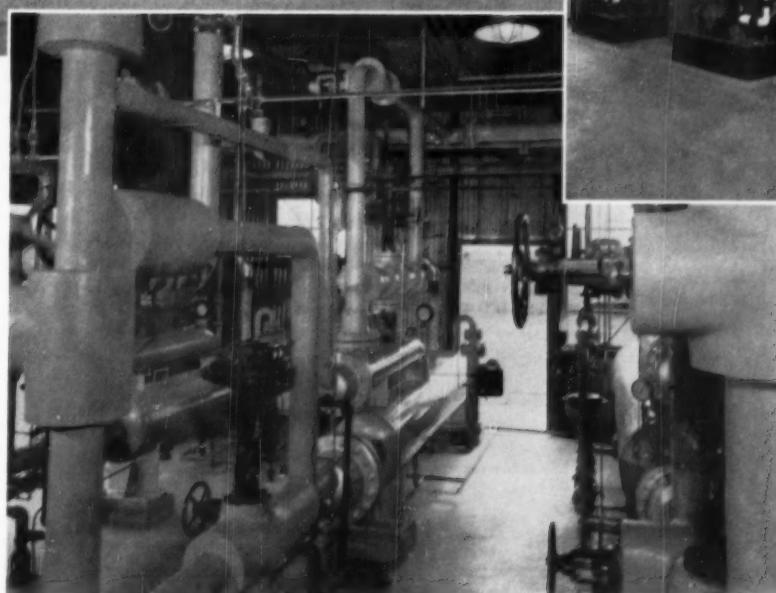
soll-Rand double-end Type 40 units were installed to bring the horsepower of the compressor installation to a total of 1500 and its capacity to a total of 6600 cfm at 125-psi pressure. Another Draketown vaporizer, having a 6000-gph capacity was also added as well as a 150-hp boiler. All of the equipment was fitted into two sheet metal buildings—one 80x40 feet and the other 28x20 feet—that were erected for the original station. Fifteen additional 30,000-gallon storage tanks and a fourth tank-car unloading station completed the expansion.

When supplemental gas is required to maintain pressure in the distribution mains, liquid propane is forced into the vaporizers, counter-flowing steam and thus is evaporated while still under pressure of about 125 psi. The vapor is routed to mixing valves where it is mixed with compressed air. The percentage of propane to air is 54 to 46, thus the propane-air has approximately the same physical characteristic as 1000-Btu natural gas. The made-gas, however, has a heat value of 1350 Btus. It is then put into the distribution mains, adding to the capacity of the system.

For the most part, the station is fully automatic, but it can be manually operated.

There are, of course, safeguards included in the event of a mishap. An automatic vaporizer shut down is actuated by either a leak in the vaporizer section or a drop in temperature of the effluent steam below a predetermined point. Air is automatically dumped to atmosphere if there is insufficient vapor pressure in the header leading to the mixing valves. The latter safeguard prevents the forcing of too lean a mixture into the mains. When either or both of the safety controls are actuated, visible and audible signals are engaged to notify the operator. The plant itself is located outside the city limits of Des Moines, Iowa, in a hazard-free area and is protected by an 8-foot-high link-chain fence. The 5-acre plot of ground on which it is located is covered with crushed stone to further isolate the facility from any danger of fire and, of course, stringent safety precautions and fire rules are observed.

Iowa Power & Light serves approximately 64,800 gas customers in the Des Moines area. The supplemental fuel provided by the propane-air plant represents about 1 percent of the total gas distributed by the concern in the city during a year.



BOILERS AND VAPORIZERS

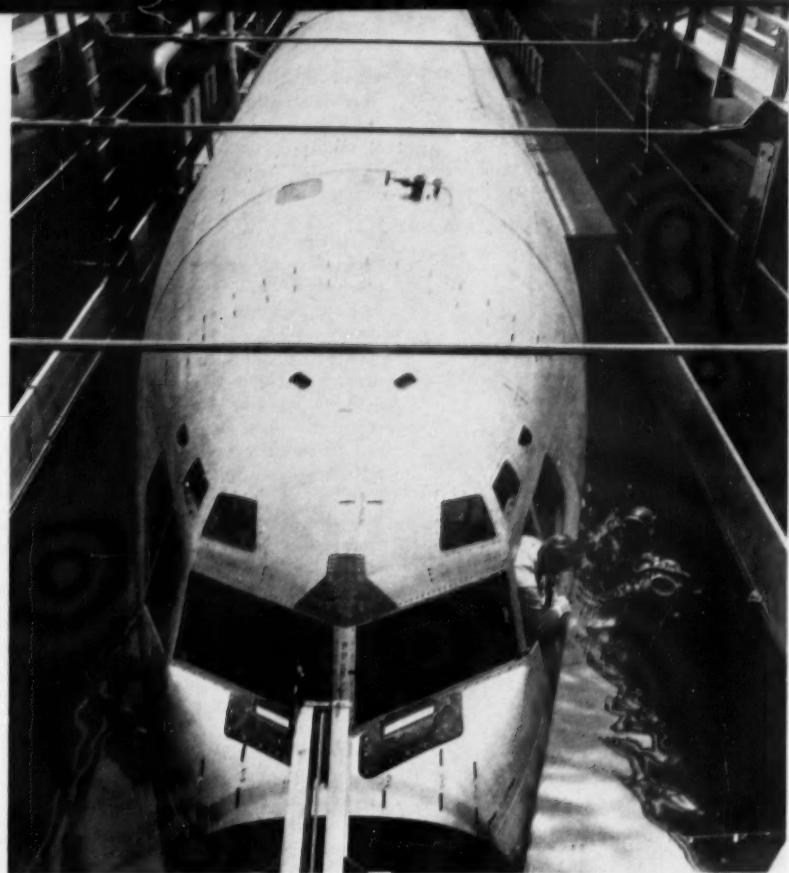
The picture above shows the three Superior steam boilers that generate steam for use in the Draketown propane vaporizers (left). The boiler in the foreground is rated at 150 horsepower and was among the equipment installed in the recent 50-percent capacity expansion of the facility. The other two units are rated to deliver 125 horsepower. The original two Draketown vaporizers, each capable of handling 4000 gph are the units at the left. The new 6000-gph unit is just visible at the right. Steam counter-flows liquid propane in these units, making it possible to vaporize the fuel while still under pressure of about 125 psi.

Skindivers Aid Boeing's

UNDERWATER FLIGHT TEST

AN unusual flight began this summer at Boeing Aircraft Company's Seattle, Wash., facilities. Marking the beginning of hydrostatic testing of a KC-135 fuselage to determine its structural maintenance requirements when subjected to repetitive flight loads, the aircraft took off by being submerged in a 420,000-gallon tank. The airplane fuselage is full-sized, yet it fits comfortably in the 20x20x130-foot container, and has room left for short wing stubs.

Most lightweight metal structures subject to such changing stresses as those encountered in flight, will eventually require maintenance of more than a routine nature. The question, of course, is when. Hydrostatic testing aims to provide the answer because such tests can exactly simulate, in about 5 minutes, all of the varied stresses encountered in a 4- or 5-hour flight. Thus the experi-



TEST FUSELAGE

Eight Boeing employees—engineers, mechanics and photographers—were specially trained for duty in the firm's 420,000-gallon hydrostatic test tank. The photo reproduced above shows the fuselage prior to being submerged in water. For simulation purposes a 5-minute "flight" in this tank is the equivalent of a 4- to 5-hour flight by an operating aircraft. After every 1500 load spectrums—"flights"—the tank will be drained, and the structure completely inspected. The skin-divers do intermediate checking.



SLEEPING WHALE

Looking much like a sleeping whale, the KC-135 Boeing fuselage is shown completely submerged in this picture. Alongside the out-of-door facility is located a test laboratory. A total of 350 strain gauges attached to the fuselage are connected to instruments in the lab.

resemble actual conditions than they did previously.

Nine different load conditions are applied to the airplane during a typical flight cycle, or flight "spectrum" as the engineers call it. They are applied in two ways—by water pressure and by hydraulic jacks. The airplane body is suspended only by the short wing stubs. Five of the jacks are located in front of the support, nine behind. Two additional ones exert torsional loads on the tail. The jacks act in a downward direction. Air tanks, incorporated inside the fuselage, apply upward thrusts whenever the jacks are not in operation.

On a typical "flight," water pressure is equalized inside and outside the fuselage at the start—normal ground conditions prevail. To simulate a climb, water is forced into the fuselage, thus building up a pressure differential. This difference in a real aircraft amounts to about

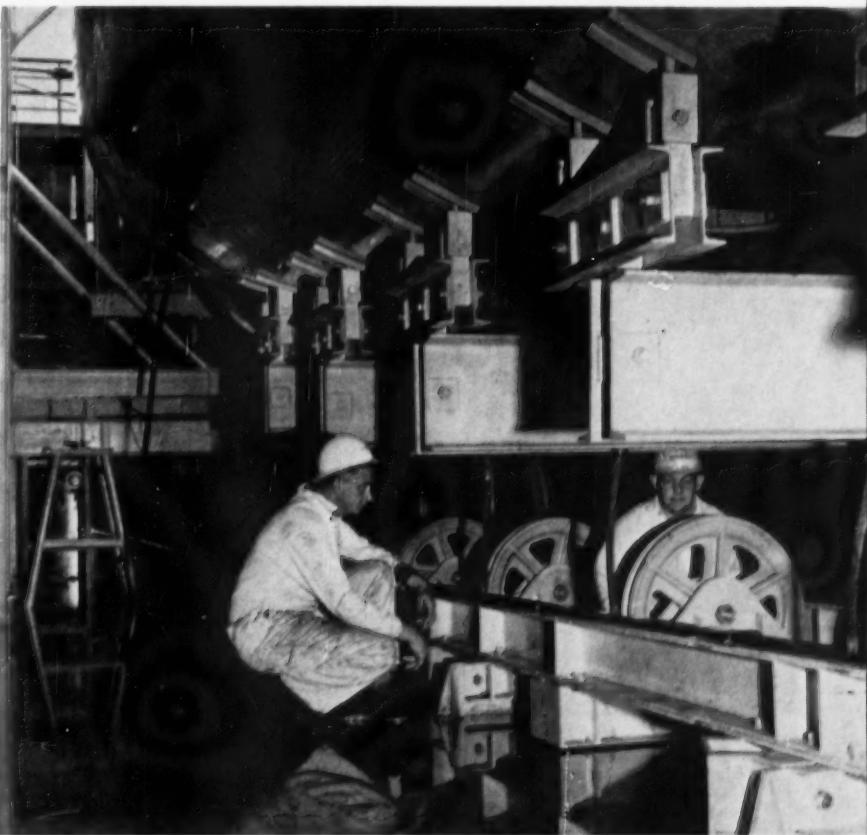
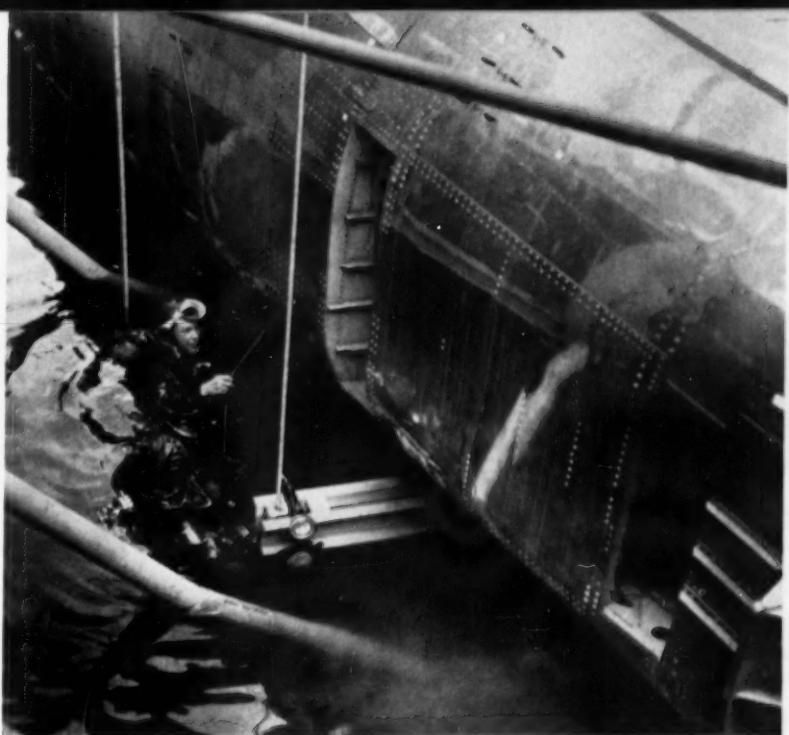
8.6-psi pressure; in the Boeing test craft the interior pressure rises to 9 psi. When the latter value is reached, that pressure is maintained for about 2 minutes, and then the water is slowly bled from the fuselage, thus reducing the pressure and simulating a descent.

The flexing of the shell during this simulated flight is not the only load applied to the test 'plane, however. Others are also imitated by application of hydraulic pressure at varying spots and times. For example, wind gusts of 13.5 feet per second are duplicated, in both up and down directions, several times during the test. Three minutes after take-off an extra-heavy wind gust, amounting to 17.5 feet per second, is applied. In all, jack loads change about 25 times during each 5-minute "flight," matching the loads a normal airplane might expect to encounter during a 4- or 5-hour trip.

The load conditions described are applied over and over again, each repetition representing a flight. (Some American airlines commonly fly a distance equivalent to that between New York and Los Angeles in about 7½ to 8 hours, nonstop.) After every 1000 times, the heavy wind gust of 17.5 feet per second is supplanted by an even heavier one of 50 feet per second. After every 1500 load-spectrum cycles, the fuselage is completely inspected for damage. As long as the damage is not critical, tests will go on and injured areas are checked frequently to determine the rate of progression—damage propagation, as the engineers call it. After several thousand flights are made, if no structural failure is evident, the fuselage will be damaged deliberately to determine the rate of damage propagation.

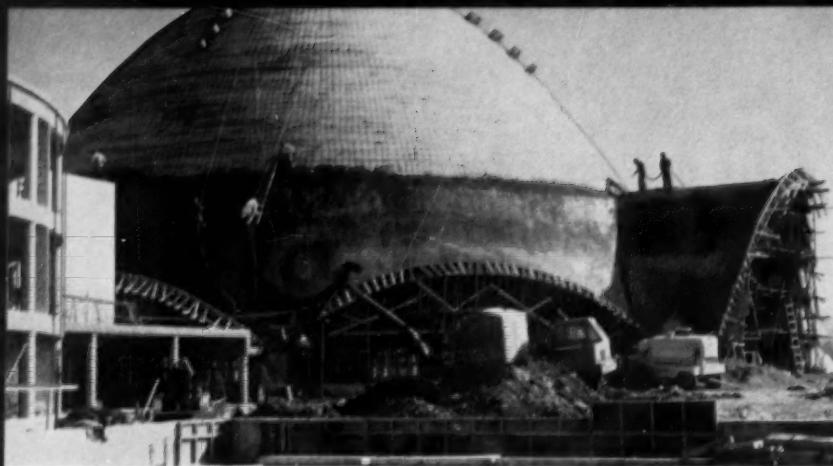
For reasons of time and cost, the tank is to be emptied no more than absolutely necessary, that is, for each major inspection. (Filling and emptying the tank requires a total of about 12 hours.) Because the fuselage is under water, some means must be provided to examine it between major inspections. Eight skin-divers are part of the program. Their job is to check anything out of the ordinary that might show up during the progress of the investigations. Most of them had no prior underwater experience and were selected because of other talents. For example, engineers, mechanics and a photographer are included in the group. All were given extensive training in underwater techniques.

Loads are read and recorded continuously during each "flight." A total of 350 strain gauges are located at strategic points on the fuselage so that test engineers know what is going on. It took 300,000 feet of wire to connect the gauges to the instruments in the laboratory alongside the tank. The hydraulic jacking system required more than 8000 feet of tubing.



LOAD SIMULATION

Fourteen jacks—five in front and nine behind the wing supports—plus two acting torsionally on the tail, apply loads. Part of the jacking equipment is shown in the lower illustration. Frogmen (top) open and close hatches and check on the progress of each test. The tank is drained only when necessary.



CHURCH OF TOMORROW

THE appropriately named First Christian Church of Tomorrow in Oklahoma City, Okla., has a new edifice that is in keeping with today's trends in contemporary architecture. A circular building, the church is crowned with a parabolic dome rising 88 feet above ground level. The diameter at the base is 142 feet. The scalloped dome edge, formed by cut out arches extending into the parabolic section, is supported by eight cantilevered columns. The columns rest on 10-foot-deep bell footings, 10 feet in diameter. The cut out arches are centered between the columns.

The concrete thin-shell dome itself has

a thickness of 8 inches at the column caps, decreasing gradually to a thickness of only $3\frac{1}{2}$ inches at the top. The upper portion is covered with stainless steel applied directly to the concrete. Twenty-nine plastic bubble-like skylights are set into it in the form of a cross. The lower section of the dome has two coats of concrete water proofing and is covered with a plastic cement and glass fiber membrane. To complete the roof, a marble-chip mix was applied to the final layer of concrete.

The dome was constructed of expanded-clay concrete applied pneumatically by True Gun-All Equipment Corpora-

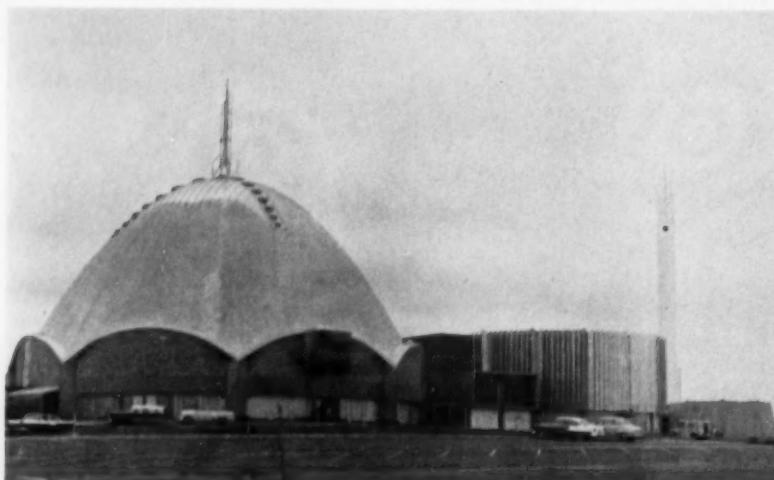
CONSTRUCTION DETAILS

True Gun-All equipment is being used to place concrete over the parabolic dome. Reportedly, one Ingersoll-Rand 125-cfm rotary Gyro-Flo compressor will handle a gun having a capacity of about 3 to 4 yards of concrete every hour. On the roof extension (right) are two men placing the mix, and directly below them on the ground is the compressor equipment.

tion using a special wet-mix gun manufactured by the firm. Consisting primarily of a pressure-chamber hopper in which carefully measured quantities of sand, cement and water are mixed by paddles, the equipment requires but one standard $1\frac{1}{2}$ -inch material hose. The latter is equipped with a pneumatically controlled valve nozzle. Reportedly the air requirement of the wet-mix equipment is about half that of a standard dry-mix-type apparatus. For example, on the Church of Tomorrow project, two Gun-All units, each having a capacity of 3 to 4 cubic yards per hour, were supplied with air by a single Ingersoll-Rand Company 315-cfm rotary portable Gyro-Flo compressor.

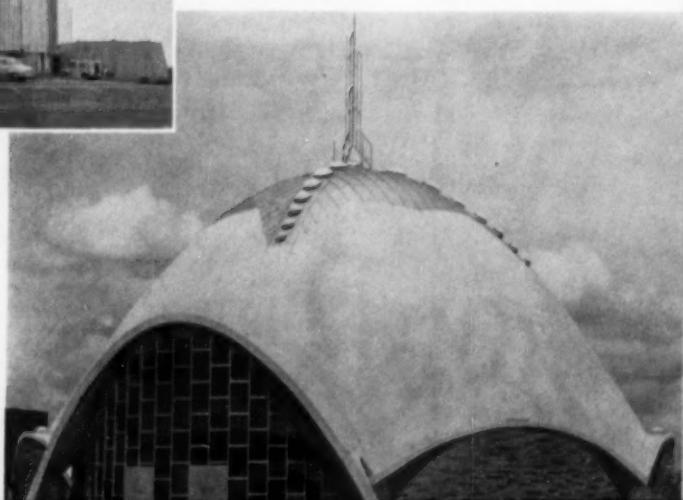
The completed church has a seating capacity of about 2000, and together with a 4-story school building, a fine arts structure and a 150-foot-high bell tower, cost \$1,124,000. The sanctuary of the church proper is cooled by a 104-ton air refrigeration installation. The latter is novel with respect to the control system; no effort is made to regulate temperatures above the 25-foot level because the cool air automatically remains near the floor or seating level, while hotter air rises to the roof.

The general contractor for the First Christian Church of Tomorrow was Frederickson & Parks; Warren E. Sullivan was the structural engineer. The True Gun-All Equipment Corporation was the subcontractor for the placement of the concrete on the dome.

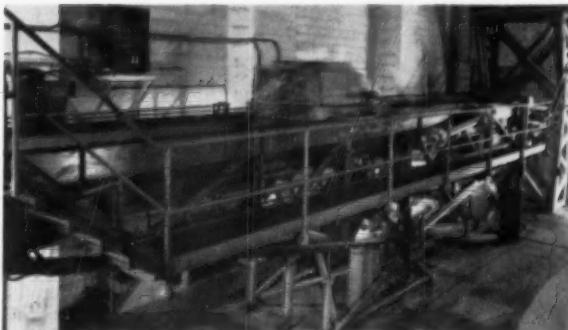


FIRST CHRISTIAN CHURCH SITE

Above can be seen the Church of Tomorrow, Oklahoma City, Okla. The dome-like structure at the far left is the sanctuary, and to its right are a 4-story school building, a 250-seat fine arts facility and a 150-foot-high bell tower. A closer view of the church is at the right. The roof is constructed of expanded-clay concrete that was applied pneumatically. Easily seen are the bubble-like, plastic skylights and the stainless steel capping.

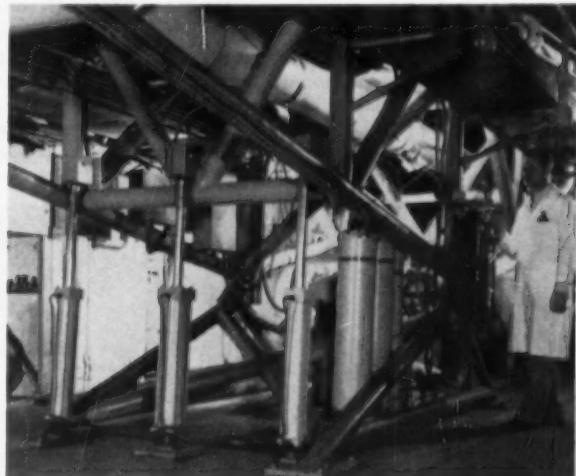


Air-Powered Slingshot— TESTS MISSILE COMPONENTS



ACCELERATION FACILITY

Shown above is a top side view of the air-operated sled for testing components that will be placed in missiles. They are checked to determine whether or not they can withstand the rapid acceleration of launching. The underside of the slingshot (right) consists primarily of three pneumatic cylinders. These are used to raise and lower the simulated runway, thus achieving the desired launching angle.



NORTHROP Aircraft Company of Hawthorne, Calif., is using a unique air-powered sled to secure information on the reliability of missile components. In a simulated launching, parts and instruments are checked to see if they can withstand the initial shock, and the latter are tested to insure that they will perform reliably under acceleration.

The compressed-air-powered facility provides any desired acceleration from 4 to 8 gs (gravities) at a controlled build-up rate (sinusoidal) variable from 40 to 140 milliseconds. Acceleration at the peak value is sustained to a total elapsed time, including build-up, of at least 0.25 second. Deceleration occurs at one half the acceleration rate. Load capacity

of the 54x56-inch sled is 1200 pounds.

In effect, the sled is a giant slingshot. A single pneumatic tube houses both driving and braking pistons, and serves as a mount for various control devices. Adjustment of the initial cavity at the head of the piston and of an initial orifice that operates at a constant upstream pressure, determines maximum acceleration and the rate of build-up.

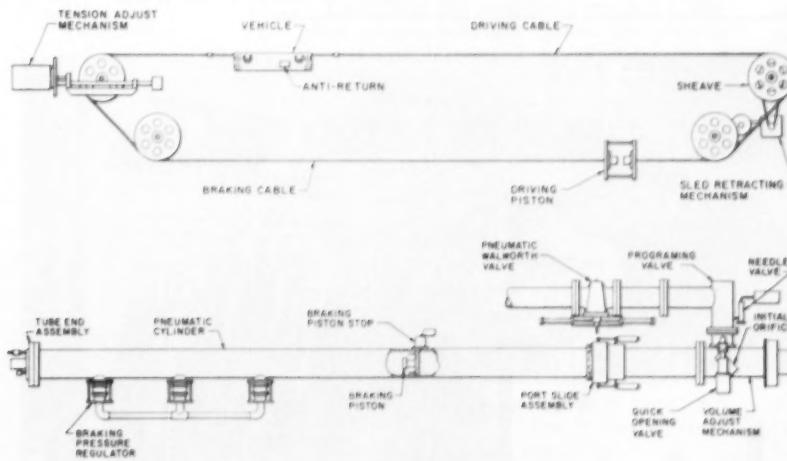
A quick opening valve triggers the acceleration cycle, opening rapidly to provide an impetus conforming to a given theoretical acceleration curve. Actuation of this valve also starts a counting device that triggers a programming valve having a capacity of 0 to 30 pounds (weight) per second when the top of the

sinusoidal acceleration curve is reached. The latter valve admits more air into the cylinder, and it continues to open at a controlled rate to keep acceleration constant.

As the driving piston passes exhaust ports, thus closing them, pressure begins to build up between the driving piston and the braking piston. The latter is under a preset braking pressure regulated to allow pick up of the braking force without overshoot. A constant braking pressure is maintained during the deceleration phase.

The quick-opening and programming valves are the heart of the facility. Before installing them in the large pneumatic tube, these valves are checked and calibrated for split-second functioning with a recording oscilloscope. The cable that transmits driving and braking forces to the sled passes through three seal assemblies. One of these is located in the braking piston, and the others are at the ends of the tube. They consist of alternate leather and felt washers soaked in light lubricating oil. Pressure forces the washers against smooth vinyl-covered cable, causing the washers to act as a seal.

Actuation of the firing switch starts a step-type relay. This in turn starts the recording oscilloscopes, calibrates all strain-gauge channels, and then "fires" the equipment. One or more oscilloscopes are used. These are preset to run 55-inch-long records at 19.2 inches per second. An oscilloscope processor, located at one end of the building in which the facility is housed, permits results to be checked almost immediately after the completion of a run. If results are satisfactory and reruns are not required, additional tests of other components are often made the same day.



SLINGSHOT SCHEMATICS

At the top is a diagram of the major mechanical operational features of Northrop Aircraft Company's pneumatic slingshot that is used to test missile components. Beneath it is a diagram showing the pneumatic system itself. The programming and quick-opening valves are the crux of the system. Oscilloscope instrumentation was developed and supplied by Consolidated Electrodynamics, Inc.

SAVING WITH AIR POWER

Pneumatics Boosts Valve Production

CONTINUED investigation of the mechanics of a seemingly simple operation resulted in the development of an air-powered rig that saves its user \$9.00 every hour. The job was to run two $\frac{1}{8}$ -inch slotted-head plugs into opposite

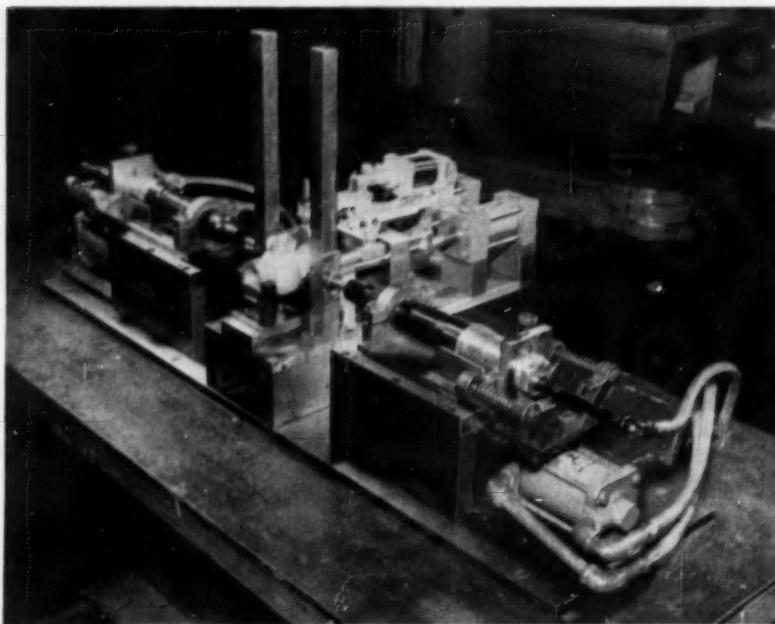
sides of a motor valve body. Two men were engaged in the operation of doping or scaling the plugs, starting them by hand and running them with a bench-mounted power screw driver. By this method, the completed assemblies were

being turned out at a rate of two every minute.

The first step in speeding up the operation was to mount two pneumatic screw drivers—Ingersoll-Rand ONC units—on sliding ways and to attach air cylinders for advancing and retracting them. The plugs were still doped and started by hand. Placing the valve into the screw driver fixture and clamping it was also manually done. Then, by actuating a valve, the two plugs were run simultaneously. Although two men were still needed for the job, production increased to 5.5 assemblies per minute. Besides direct labor savings of \$56.00 per day, the production engineers noted that the plugs were more uniformly torqued. This arrangement worked well for several million cycles over a 4-year period.

When engineers again studied the operation to see if further improvements were possible, air power once more proved the answer. Another machine was built using two Ingersoll-Rand OBNC screw drivers fed by air cylinders. Still another cylinder was used to clamp the valve body, eliminating that manual step. Two additional cylinders were applied to automatically inject plugs into position, and a hopper and gravity-feed system were included to bring the plugs to the cylinders. Even the scalant or dope compound was automatically applied.

With this new equipment, only one worker is required to turn out 5.5 completed pieces every minute. An additional cost saving of \$16.00 a day was thus realized, boosting the over-all air-power saving to \$72.00 a day.



PNEUMATIC PLUGGING

On this machine, the work is clamped into position pneumatically, the plugs are injected by air power, and two OBNC Ingersoll-Rand screw drivers are fed into the work by air cylinders. The daily saving now amounts to \$72.00 per day.

MECHANIZED COWPOKE

Things have changed out on the range, pardner. Why even the old branding iron isn't the same; got one now that runs on electricity (right). A product of L & H Manufacturing Company, Mandan, N.D., the unit requires a 110-volt alternating current power supply. The heating elements, shown in the insert, are of tubular construction similar to those in a modern electric stove and can be furnished in any desired shape. A universal brander for making most common brand symbols is also available. The concern makes electric dehorners and horn branders as well. The latter, using much smaller figures than the hide branding iron shown, have been adapted to any burnable object and are frequently used for marking shovel handles, ladders, scaffolding and the like. The contraption holding the critter in this picture is the modern cowpoker's version of a hogtying lariat. The animal is herded into the cage and the sides are moved in to hold it securely. According to veterinarians, modern cow punching is not only easier on the cowboy, it is easier on the cow.



EDITORIAL

Selling An Industry

BUILDING CONTRACTORS

A NEW television program, "Building America," scheduled to start this fall, will be a documentary series. To be shown weekly by more than 200 stations, the story of the nation's largest industry—construction—will be viewed by an audience estimated at more than 7,500,000 persons. Sponsored by the Producers' Council, each program will be made up of four 5-minute documentary films. The Producers' Council itself represents about 200 building-material and equipment producers and associations. Founded in 1921, local chapters are established in 41 major marketing areas of the United States. "Building America" will also feature a talk by a leading member of the industry, either on a local or national level, as well as statements by administration and congressional leaders as to government policies relating to the industry.

The series will be produced by the Public Service Network, and the films will be made available to local television stations free of charge, providing that they are run on a regularly scheduled basis. Cost of the program will be borne by "participants" with local time charges carried by local segments of the building industry. According to the president of the Producers' Council, F. M. Hauserman, "This is the first time that any concerted industry-wide effort has been made to inform the public of the importance of the building industry to its living standards and modes of living."

SO KIDS CAN'T GET HURT

FOR MORE than 30 years, the explosives industry, through the Institute of Makers of Explosives, has conducted an all-out campaign warning children against the perils of playing with blasting caps. With the aid of youth groups, law enforcement officers, teachers and governmental agencies, the campaign tells children what blasting caps are, and how dangerous they can be in—and to—untrained hands. Such an effort is easily classified as an attempt to sell the explosives industry to the public—to get John Doe to bestow his esteem.

The coöperation of the men and companies that use blasting caps has been vital to the campaign—is just as important as the education of the children. The Institute is now engaged in an effort to push home to contractors and mining and quarry men the paramount point that the best way to keep children from getting hurt by blasting caps is to keep them out of the hands of reckless or daring youths who "just want to have a little fun." The current campaign stresses, "Lock them up!—So kids can't get hurt."

That the campaign pays off is readily apparent. It is reported that the number of children hurt each year by blasting caps or other forms of high explosives has been steadily

decreasing, although activity in the construction field has been at an all time high of late. This particular effort can be classed as one that has already sold an industry—the campaigns now are to keep it sold. The Institute and the men responsible for the safe use of blasting agents can be justifiably proud of their efforts, and the nation's parents and children owe them a vote of thanks for their unrelenting efforts to protect unknowing little fingers.

THE PETROLEUM SCHOOL SERIES

FOR MANY years one of America's greatest industries has been quietly carrying on a program designed to sell itself to the next generation of public opinion makers. Through the American Petroleum Institute, the industry has sponsored a remarkable series of study aids, designed to be used in schools, that present factually and completely the story of oil and how it fits into the American economy. Complete with teachers' handbooks and study guides, the series presents information on general science, chemistry, physics, social studies, economics, conservation and careers in the petroleum field.

Well written, the pamphlets and fliers that make up the series run from comic-book-type treatments to formal academic presentations. Teachers have been known to comment that more textbooks should make it so easy and pleasant for students to learn. Visual aids are a big help to the success of the program; movies about oil treat as many or more general and specific subjects as do the printed portions of the program, and all are expertly and professionally produced.

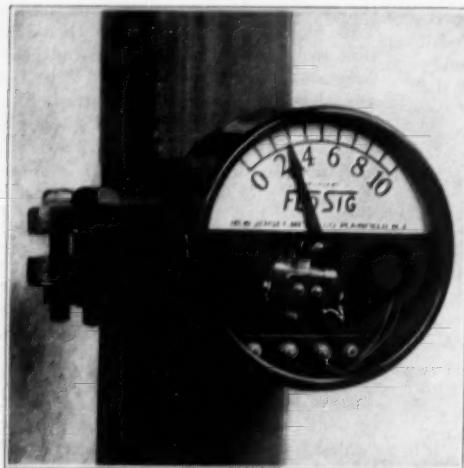
In addition to the school aids, much material of the same nature is available to clubs and adult study groups. Speakers and colorful supplementary literature, films, etc., are available through any of fourteen district offices of the Oil Industry Information Committee of the American Petroleum Institute. All material available from OIIC is furnished free of charge. Certain other movies about oil can be purchased or rented for nominal fees.

INDUSTRY ASSOCIATIONS

THE THREE associations mentioned are not the only ones that are doing a job of selling their industry. The Compressed Air and Gas Institute, for example, in the field served by this publication, has available a wide variety of information. Other institutes and groups do more or less "public relations" work. Much of this is aimed, not at the general public, but at special technical groups, but all is carefully designed to sell an industry. Executives of the participating companies that, in the long run, must pick up the tab for the expenses involved, feel that anything that benefits the industry as a whole will benefit their companies.

FLO SIG

The Electric Signal Flow Indicator that reports trouble before it happens.



FloSig in 6" vertical line, showing simple installation of gate ring between standard pipe flanges.

FLO SIG for lines carrying cooling water, oil, or other liquids.

FLO SIG for steam and ammonia condensers, transformers, generator air coolers, cylinder jackets, water cooled rolls, heat exchangers, etc.

FLO SIG for vertical or horizontal installation and any direction of flow. Pipe sizes from 3" up. One or two mercury switches, adjustable for any rate of flow.

FLO SIG for operating trip coils, valve motors, contactors, signal lights, horns, etc. on failure of flow or when flow exceeds required volume.

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PLAINFIELD, NEW JERSEY

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Adv. 20

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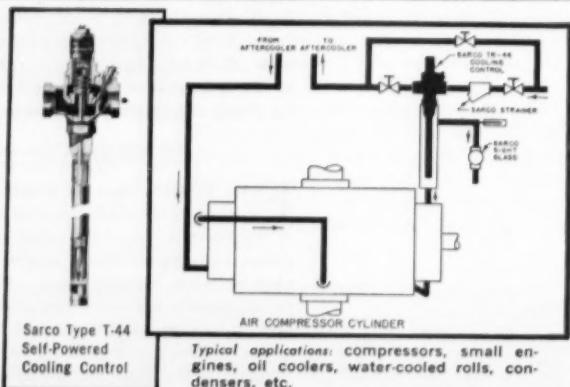
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PROTECT COMPRESSORS

against undercooling and overcooling

Undercooling cuts down compressor capacity . . . often damages cylinders, other parts.

Overcooling increases wear, destroys lubricants, wastes water.

You can avoid these troubles, step up the performance of your compressors, reduce maintenance, save water and lubricants. How? By replacing uncertain manual control of cooling water . . . by **automatic**

control with Sarco self-powered temperature regulators.

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Inexpensive. Simple. Require no outside power source. Packless. Easy to install by any pipefitter.

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Sarco Co., Inc., Empire State
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SARCO

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COMPRESSED AIR MAGAZINE

This and That

Telephones For Deaf And Blind for the Welfare of the Blind. Messages are typed out on a keyboard at the sending station, transmitted over wires as signals, and reconverted into Braille word patterns at the receiver. The receiver is housed in a box. It contains tiny devices shaped somewhat like ordinary pins. These pop up to form the words at a rate of about 100 words per minute. Reading the message will be done with the finger tips, and answers can be given orally. The first such unit was designed in The Hague, Holland, by Gerritt van der May and W.L. van der Poel. A similar machine has been in use there for communication over a distance of 60 miles.

★ ★ ★

Development of Atomic Standards is an attempt to arrive at international standards. Sixty-one delegates from thirteen countries met at Geneva, Switzerland, the first week in August, attending a conference of the International Organization for Standardization. The organization has 38 member countries. Six areas for future work were outlined by the group. Briefly these are: development of a trilingual glossary of terms; development of a warning signal or symbol for use wherever ionizing radiation is present;

adoption of units of measure pertaining to nuclear energy; development of symbols for drawings; development of recommendations for measurement of radiation and protection against radiation; and development of internationally acceptable guides treating the safe design, operation and maintenance of nuclear reactors.

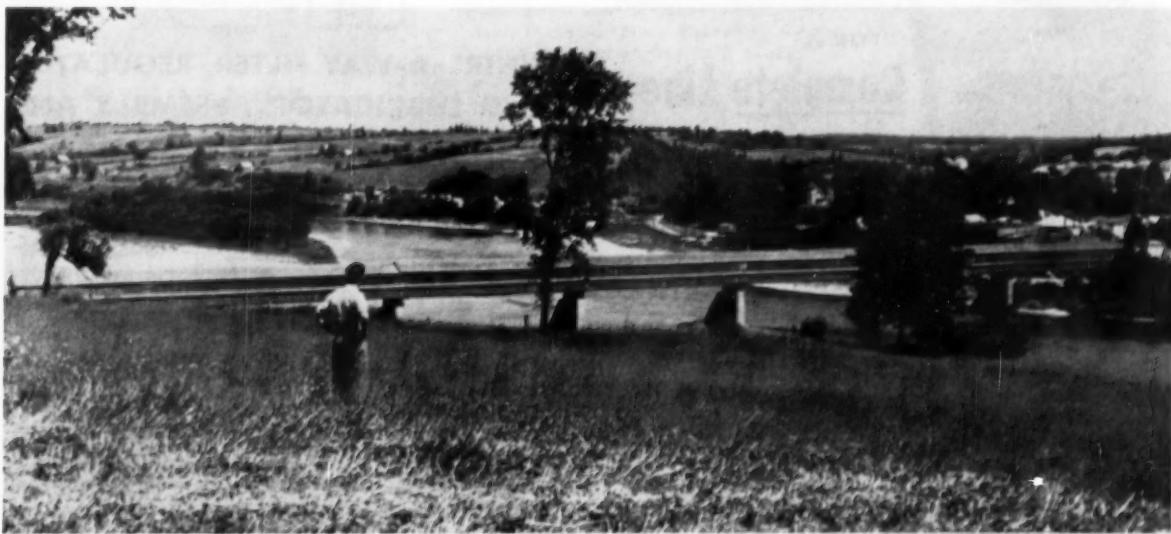
★ ★ ★

A nationwide team of government and industry scientists is getting ready to cut the familiar inch down to measurable slices as small as one tenth of one-millionth. Underway for the past year, Project Split Inch aims to develop an absolutely accurate set of standard "master" references for measuring the inch to those tolerances. The increasing fineness of industry tolerances has led to this project, and it is hoped that many products on the drawing boards—unable to be made because of the critical tolerances involved—will benefit from the investigations. Finely finished metal blocks, pure light sources, controlled compressed-air streams and precise optics are the tools of the researchers. As an example of what is planned, the project hopes to be able to split a sixteenth of an inch into 625,000 pieces, figuratively speaking, and then measure each piece with precision. Under the direction of the Bureau of Standards, the project is being supported by a number of companies in the gauging and tooling fields.

Because it is an inert gas **Helium Gas** helium has won an important role in boosting the **Satellite** earth satellite into its orbit. It will be used to pressurize the liquid propellant tanks of the second stage rocket engine of the launching vehicle. The pressurizing gas must be inert so that it will not react with the propellants—or the plumbing—in the rocket. Of the inert gases, only nitrogen and helium are available in quantity. Helium was chosen because it is the lighter of the two. The second stage rocket will fire at an altitude of about 37 miles and is expected to boost the satellite and the third stage to a height of 300 miles. The third stage will then accelerate the tiny moon into its orbit.

★ ★ ★

Preloding Reduces Ship Dock Time In order to substantially reduce the turnaround time for its cargo vessels, the Swedish Lloyd Company has inaugurated a new loading method. Basically it consists of having the goods ready at the quayside, on pallets or in manilla slings, before the arrival of the ship. Loading time has thereby been reduced from 5 days to 1. Discharge time has been cut from a day and a half to but 5 hours. The time saved benefits the port as well as the vessel, because facilities can thus handle more ships in a given period. Although there is some variation, goods are commonly stacked on pallets in 2-ton loads and



PHOTO, CANADIAN NATIONAL RAILWAYS

WORLD'S LONGEST COVERED BRIDGE

Canada's Province of New Brunswick has more than 215 covered bridges including the longest one in the world (above). It stretches 1282 feet over the St. John River at Hartland. Still in daily use, these covered wooden struc-

tures are much photographed by visitors, and many have been subjects for artists. According to engineers, covering protects their large timbers from weathering and prolongs their lives by as much as from 20 to 70 years.

placed in slings in 1.5-ton aggregates. Fork lift trucks are widely used in the preloading scheme. Operations are scheduled to start at the quay about 5 days before ship arrival.

* * *

Automatic Weather Forecaster Development of an automatic weather forecasting station has been announced by the Societe Telecommande et de Télemecanique of France. Developed for use in the Sahara Desert, the station has been adapted for use in Antarctica in connection with International Geophysical Year expeditions in the frigid southland. The meteorological station can function for many months without human help or guidance. It is powered by batteries that require recharging only at 6-month intervals and indicates wind direction and velocity (up to 144 mph), temperatures from -113° to 140° F., barometric pressure and other atmospheric information. The station consists of three steel towers and a small hut housing the battery, time-control device and a 7-drawer sealed cabinet containing broadcasting equipment, barometer, totalizers, coding mechanisms and other controls. Two of the towers carry antennae and a wind gauge and the third, a wind-powered dynamo that is used to re-

charge the batteries. The registering instruments are linked to an electromagnetic brain that codes information received, passes it on to the broadcasting unit and stops the broadcast when the transmission is complete. The brain is controlled by a pendulum clock. The broadcast equipment has a maximum range of about 900 miles under good radio conditions. Bulletins are broadcast on a regularly scheduled basis, and each is preceded by the station call letters repeated fourteen times. The bulletin itself is repeated three times.

* * *

Road to Link Bogota and Rio de Janeiro

Presented to the Seventh Pan-American Highway Conference in Panama City, Panama, during August. From Rio, the road is to pass through Brasilia, Chachimbo, Jaccare-Acanga, Nova Olinda and Manaus, Brazil, and Mitu, Columbia. The road will set Rio closer to the Central and North American nations and aid in the development of the rich Brazilian interior. It will also provide rich trade opportunities for both nations. Portions of the proposed routing already are complete in Brazil. The road would have to

cross some rivers and streams of no mean width. In the initial stages of construction, the planners say, such crossing would be made by some provisional means, perhaps ferries, pending the erection of the large bridges necessary.

* * *

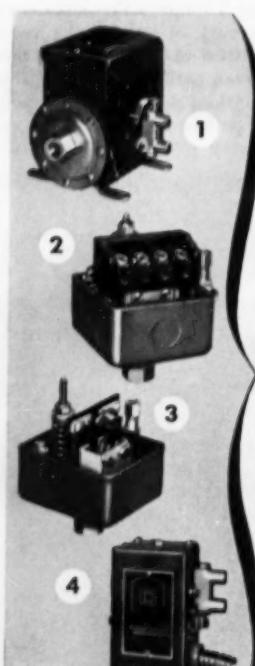
Piggyback Post Office Soon the United States mails will be going over the New York Central Railroad's lines via piggyback.

The mail will be placed in removable trailer bodies that can ride the highway on a set of roadway wheels. The trailer, built by Freighauf Trailer, will be shifted by hydraulic lifts to railroad flatcars. If successful, the system may return some post office business to the railroads and may even mean a new method of transporting general freight.

* * *

Withstanding Extreme Temperatures

How much heat can a human being stand before suffering a nervous breakdown? This question is critically important to engineers designing fast-traveling aircraft that are heated by air friction, and was answered recently by the American Society of Mechanical



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FOR A
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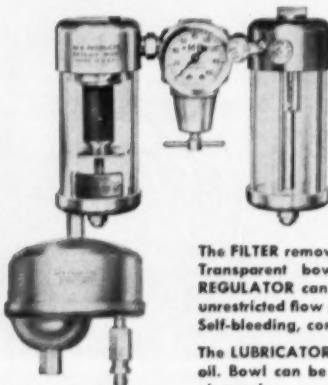
*Write for Bulletin 550,
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SQUARE D COMPANY

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SUCCESSFULLY USED FOR PROTECTION OF AIR VALVES CYLINDERS CONTROLS PNEUMATIC TOOLS, ETC.

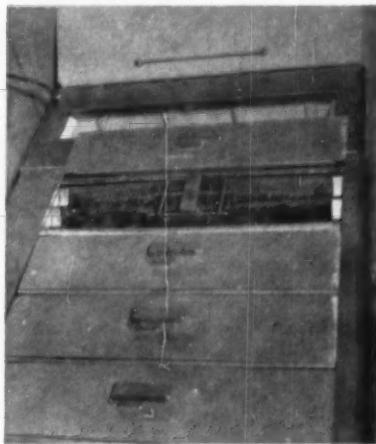
The FILTER removes solids .00039 and larger. Transparent bowl provides visibility. The REGULATOR can pass large volume with an unrestricted flow and minimum pressure drop. Self-bleeding, compact!

The LUBRICATOR delivers desired volume of oil. Bowl can be refilled without shutting off air supply.

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Engineers. It has been determined that a man covered with 1 centimeter of clothing might remain as long as 1½ minutes in air at 900°F without collapse. Without protective clothing, he might survive a third of that temperature for the same period of time. In experiments with temperatures between 120° and 235°F, it was noticed that after three quarters of the safe exposure time, student pilots began to experience dizziness, faintness, mental confusion, nausea and other symptoms. There was a marked increase in the number of errors in handling controls. It was pointed out, however, that many factors enter the picture. Individual health, perspiration, blood circulation, and the like must be considered. It was further noted that it is difficult to secure accurate data from real situations, for people who have just survived extreme heat, such as those who have just emerged from a burning building, do not usually remember any detailed information about temperature or other conditions.



PHOTO, LINDE AIR PRODUCTS COMPANY

NITROGEN BUBBLES AID COLOR PHOTOGRAPHY

To produce high-quality color photographs, great care must be taken—much more, it is said, than with black and white film. For example, a variation of as little as 2 volts in the power supply of light sources used in printing from color negatives may adversely affect the color balance of the resulting print. Another variable is the amount of agitation that negatives receive during the developing process. Some technicians can easily develop the proper technique to get good results by hand agitation of the developing fluid, but it is a tedious and time-consuming job. H. Leiber Company, Indianapolis, Ind., solved the problem of getting uniform agitation by using nitrogen bubbles to circulate the developer in much the same way that dairies agitate milk with air bubbles. Nitrogen is used instead of air because the oxygen in air oxidizes the developer and causes its quick deterioration. This picture shows one of the firm's developer trays that has been converted to nitrogen agitation. The gas is supplied by Linde Air Products Company.

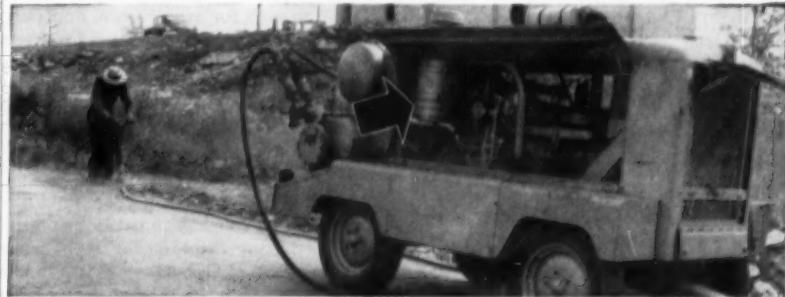
**Heating
Iron Ore
Shipments**
Infra-red rays, generated by a gas device, will be helping the shippers of iron ore this winter. In the past, both railroad and boat men have not been able to transport ore from November to April because it tended to freeze at the loading points, remain frozen throughout the journey, and not to thaw upon the arrival at its destination. Dumping the substance and handling it resulted in a severe economical problem. With the new method developed by Hupp Corporation's Perfection Industries Division, railroad cars can be thawed in a matter of minutes.

**Nuclear Ship
Propulsion
System**
The Atomic Energy Commission and the Maritime Administration have invited industry to submit proposals to develop a nuclear power plant suitable for propelling merchant ships. The invitation, extended August 1, calls for a gas-cooled reactor coupled with a closed-cycle gas turbine. From the proposals received, the joint interagency group will select a contractor to carry out necessary developmental work. The administrative offices expect it will be possible to construct a prototype plant within a 5- to 7-year period after the initial work order is awarded.

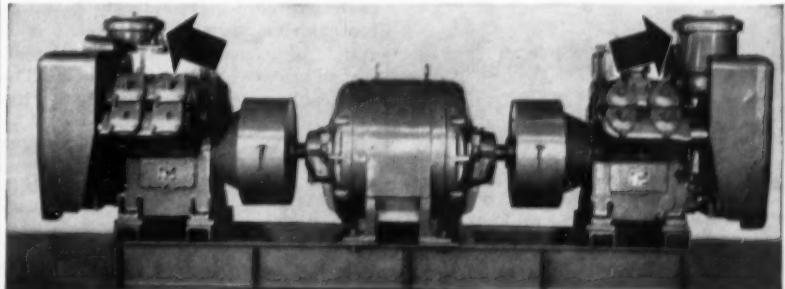
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Whether you break ground or production bottlenecks

*Air-Maze filters will
keep your compressors on the go!*



Breaks Ground for highway repair. This calls for dirt-free air to protect precision parts of portable tools and compressor cylinders against premature wearing and scoring. So to assure operating dependability, cut downtime and engine overhaul, contractors rely on Air-Maze filters to scrub dirt-laden intake air completely clean in a bath of oil.



Breaks Production Bottlenecks. This manufacturer insures continuous, trouble-free operation of automatic production machinery by using only filtered air in control systems. Erratic operation and production breakdowns are avoided because Air-Maze oil bath filters keep airborne dirt from close fitting pistons, valves and control components.

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Industrial Notes



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The female-type coupling you can rely on for tight, safe connections on the big drills; manifolds; jumbos; in caisson work; and all other high-pressure operations. Copper insert in spud fits rounded head of stem, forming soft-to-hard, leakproof metal seal. "Boss" Offset Interlocking Clamp provides powerful grip on the hose—proof against blow-offs. Also available in washer type, and with companion male coupling. Sizes $\frac{1}{4}$ " to 6".



"BOSS" HOSE MENDER STYLE BM-16

The practical, safe way to quickly restore damaged hose to service. Complete fitting consists of mender tube and two "Boss" Interlocking Clamps. Tube has flanges to engage clamp fingers. Tube shanks have well-defined, smooth corrugations. Thoroughly rustproofed. Sizes $\frac{1}{2}$ " to 6".

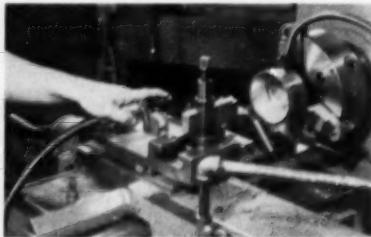
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DIXON Valve & Coupling Co.

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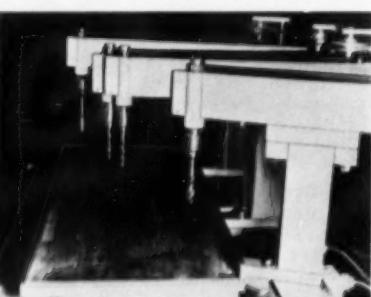
A magnetic air-hose holder that clamps a nozzle to any ferrous material at the point of use has been developed by The Dilley Manufacturing Company. The device consists of a pliable rubber nozzle fastened to an Alnico magnet either of 110- or 35-pound pulling power. Slight, 1-finger pressure is sufficient to bend the nozzle tip thus starting the flow of air; the blast is shut off when the pressure is released. Ability to place the hose nozzle at the point of use means a



machine tool operator, for example, doesn't have to step away from his machine to reach for an air hose, and only one motion of his hand is needed to clear away machine cuttings. The device without the air nozzle can also be adapted to position coolant tubes and paint spray nozzles.

Circle 2E on reply card

ABM Machinery Corporation has announced an automatic, adjustable multi-spindle drilling machine for rapid mass sinking of multiple holes in wood, metal or plastics. Five models are available with working lengths of 4, 8, 12, 16 or 20 feet, making it possible to drill a varied pattern of holes from $\frac{1}{2}$ to 240 inches apart. A basic 4-foot model is supplied with four individually adjustable heads, each with an independently operated motor drive, variable from 900 to 3600 rpm. Additional drill heads can be added to achieve any pattern of holes. The worktable rises, pneumatically or hy-

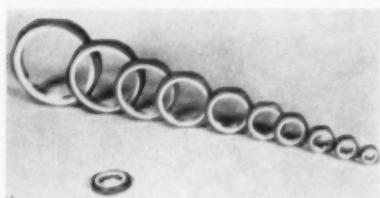


draulically, to the spindles at adjustable feeds of from 5 to 150 inches per minute. It has a maximum adjustable travel of 6 inches, and the return stroke is automatic. The manufacturer claims that

fast, easy setups are facilitated because the work need not be centered on the table and the machine is not affected by unbalanced load conditions.

Circle 2E on reply card

A surface treatment that offers resistance to corrosion of Tru-Seal self-sealing pipe fittings, has been announced by Flick-Reedy Corporation. Edges of the nut-like fitting, designed to stop leaks at threaded pipe connections have been cropped and rounded off to make the devices more compact. The unit seals by means of a threaded Teflon plastic insert. Fittings with a chromated cadmium surface treatment—a gold-colored finish—reportedly withstood the 100-hour salt-spray test of Steel City Testing & Engineering Laboratories, a test that is said to duplicate a life time of operation under the most punishing conditions. The unit holds its seal under ultimate pressures of 10,000 psi, and under temperatures ranging from -200° to 500° F. The milky-white



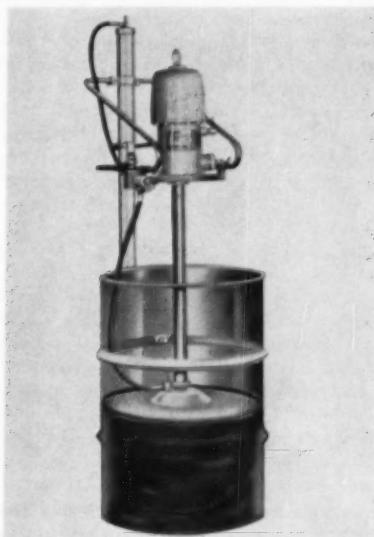
plastic insert is inert to virtually all known chemicals and reportedly can be used in pipe circuits carrying oil, water, gas, air, steam, chemicals, and in vacuum lines.

Circle 3E on reply card

For welders who touch up their own welds, General Electric Company is marketing a Glyptal coating compound in a 16-ounce pressure pack. One containerful is said to give corrosion protection to more than 85 square feet of surface. The coating method is more rapid than conventional brush procedures, and because a narrow spray pattern is produced, is ideal for welded joints. The compound is a clear synthetic varnish that can be used to protect against corrosion and oxidation of metal pieces being stored prior to finish painting, as an antispatter compound, and as a primer for finish paint.

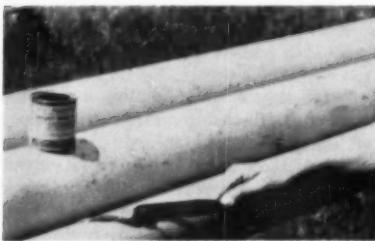
Circle 4E on reply card

A type of pumping unit designed to dispense—directly from 55-gallon drums—caulking compounds, putties, semi-fluid sealers, adhesives and similar materials that may be too thick even to be poured, has been developed by Gray Company, Inc. Inductors, as they are designated, completely seal the material



in its container, thus eliminating contamination, spillage, channelling, aeration and waste. The units begin at the top of the substance in the container, then "suck" their way to the bottom. Reportedly, even the sides of the drum are scraped during the action. Units are also available in $\frac{1}{2}$ -drum and 5-gallon-pail sizes. *Circle 5E on reply card*

An emergency repair kit containing Plastic Steel (80-percent steel, 20-percent plastic) for on-the-spot repairs of tanks, pipes, pumps, valves and other types of machinery is available according to Devon Corporation. With a texture similar to that of modeling clay, it can be formed into any shape and will not run or sag when applied to a vertical surface. Two hours after the addition of



a special hardening agent, the substance becomes a strong, tough, rigid metallic bond, without applying heat or pressure. It is reportedly durable, permanent, essentially nonshrinkage or expanding, rustproof, and can, it is said, harden under water.

Circle 6E on reply card

Model VH-20 vacuum regulator reportedly affords accurate control of vacuum in low-capacity systems and is capable of holding absolute pressures as

2-cylinder models
10 to 18 hp.



4-cycle single cyl.
models, 3 to 9 hp.

• **Load-Holding Lugging Power!**
That's what you get when you specify Wisconsin Heavy-Duty Air-Cooled Engines... engineered for HIGH TORQUE performance.

Here is power that *hangs on* through the shock loads... and *carries on* under either variable or constant-load operating conditions.

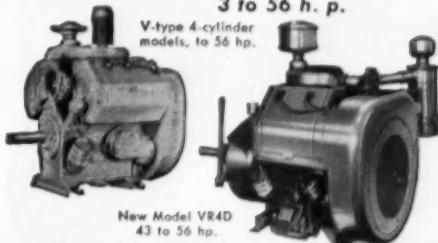
Wisconsin basic HIGH TORQUE design pays off in terms of "Most hp. Hours" of on-the-job heavy-duty service, at all temperatures

from low sub-zero to 140° F.

Team-up your equipment with Wisconsin HIGH TORQUE Champs—backed by over 2,000 Wisconsin Authorized Service Stations, world-wide. Write for full-line "Spec" Bulletin S-212.

WISCONSIN ENGINES

3 to 56 h. p.



V-type 4-cylinder
models, to 56 hp.

New Model VR4D
43 to 56 hp.

WISCONSIN MOTOR CORPORATION

World's Largest Builders of Heavy-Duty Air-Cooled Engines

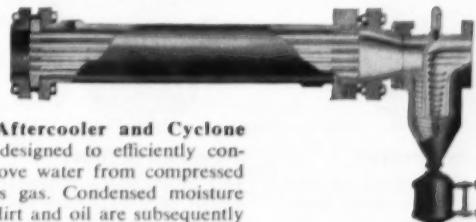
MILWAUKEE 46, WISCONSIN

Circle 24A on reply card

A7-6105-1/4A

Aftercooler and Cyclone Separator designed for cleaner, dryer compressed air

R. P. ADAMS CO., INC.
209 East Park Drive, Buffalo 17, New York



The Adams Aftercooler and Cyclone Separator are designed to efficiently condense and remove water from compressed air and process gas. Condensed moisture and entrained dirt and oil are subsequently removed in a cyclone type separator. This unit is scientifically designed for maximum removal efficiency over a wide range of flow rates.

For normal use, units are available to cool gases to within 10° F of the temperature of the cooling water. Specially designed units are available to permit a 2° F approach to cooling water temperature, for application where low moisture content is critical.

Adams Aftercoolers and Separators are available from stock to handle 20-40,000 cfm with 10° cooling and 25-19,200 cfm

Circle 25A on reply card

where it is necessary to cool within 2° F of the cooling water. Special units can be supplied to suit an unlimited range of requirements. In all cases the maximum pressure loss at rated capacities is $\frac{1}{2}$ psi.

This wide range of sizes enables the economical utilization of Adams Aftercoolers and Separators in virtually all industrial application. For further information on how R. P. Adams' units will solve your compressed air problems and save you money, write today for Bulletin 711.

VICTAULIC®

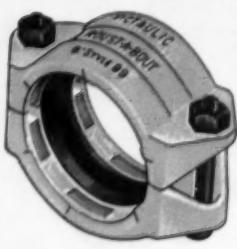


METHOD OF PIPING

VICTAULIC HAS EVERYTHING...



VICTAULIC COUPLINGS
Simple, fast, reliable. Styles 77, 77-D, for standard uses with steel or spiral pipe, — Style 75 for light duty. Other styles for cast iron, plastic and other pipes. Sizes $\frac{3}{4}$ " to 60".



ROUST-A-BOUT COUPLINGS
For plain or beveled end pipe Style 99. Simple, quick, and strong. Best engineered and most useful plain end coupling made — takes a real "bulldog" grip on the pipe. Sizes 2" to 12".



VICTAULIC SNAP-JOINTS
The new, boltless, speed coupling, Style 78. Hinged into one assembly for fast piping hook-up or disassembly. Hand locks for savings in time and money. Ideal for portable lines. Sizes 1" to 8".

COUPLINGS FOR EVERY PIPING JOB



VICTAULIC FULL-FLOW FITTINGS

Elbows, Tees, Reducers, Laterals, a complete line—fit all Victaulic Couplings. Easily installed — top efficiency. Sizes $\frac{3}{4}$ " to 12".



VIC-GROOVER TOOLS

Time saving, on-the-job grooving tools. Light weight, easy to handle — operate manually or from any power drive. Sizes $\frac{3}{4}$ " to 8".

PLUS FITTINGS AND GROOVING TOOLS

"EASIEST WAY TO MAKE ENDS MEET"

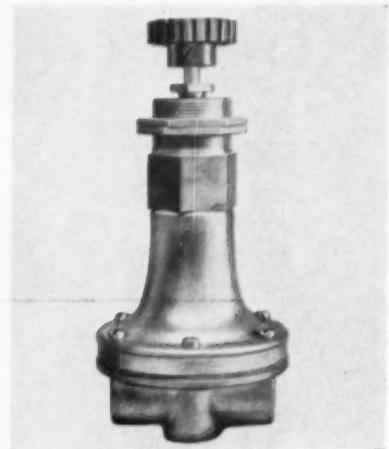
Promptly available from distributor stocks coast to coast.

Write for NEW Victaulic Catalog-Manual No. B-9

VICTAULIC COMPANY OF AMERICA
P. O. BOX 509 • Elizabeth, N. J.

Circle 26A on reply card

low as 1 inch Hg with a tolerance of plus or minus 0.05 inch Hg. Manufactured by Conoflow Corporation and



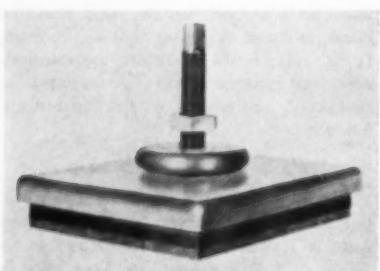
available from stock in $\frac{1}{4}$ -inch size, the unit is made of forged brass and stainless steel. It has been used widely in the aircraft industry as well as in government testing programs where accurate simulation of high-altitude conditions was required.

Circle 7E on reply card

Nonwoven, rayon wiping and polishing cloths, treated with silicone to give a protective, odorless, nonoily, nongreasy coating to highly finished glass, plastic and metals, are available to industry in 100-cloth packages from Edmund Scientific Company. Protection is furnished against finger prints and the etching action of skin acids, dust, lint, mildly corrosive atmospheres and other deteriorating industrial wastes such as grits and moisture. Continued use is said to impart a smooth water-repellant finish that reduces future maintenance. It is ideal for reflectors, precision gauges and tools, lenses and other critical surfaces.

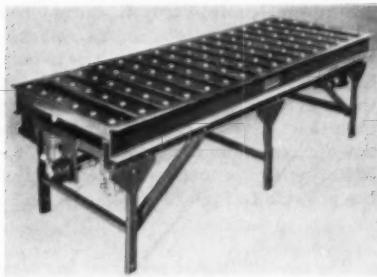
Circle 8E on reply card

Level-Rite is a self-leveling machinery mount developed by Unisorb Division of The Felters Company. It consists of an all-steel base, a Unisorb vibration-dampener pad and a leveling screw and plate. Seven models are available with loading ranges of from 800 to 7500 pounds per unit, one unit being required



for each machine leg or mounting point. Reportedly the units can be anchored easily without bolts, lag screws or cement. Design is such that positive hold without walking or creeping is possible even under severe side loads. Its Screw-Post design promotes quick, easy leveling. The pad reportedly reduces transmitted vibrations by 85 percent. It will not deteriorate—is resilient and impervious to cutting fluids and cleaning compounds. *Circle 9E on reply card*

Four air cylinders operating on approximately 100-psi pressure actuate Sage Equipment Company's Liftable. Rows of balls are set in holes in the table top. When the top is raised, the balls become recessed and a load on the table, no longer in contact with them, is held firm. When the frame is lowered, the balls protrude and support the load so that it can be easily moved in any direction. The illustration shows this



ball transfer base; however, according to the company, roller bases are available for applications where loads are to be moved in only two directions. Units are manufactured in 5- and 10-foot lengths and in widths to 48 inches and have capacities ranging from 1000 to 10,000 pounds.

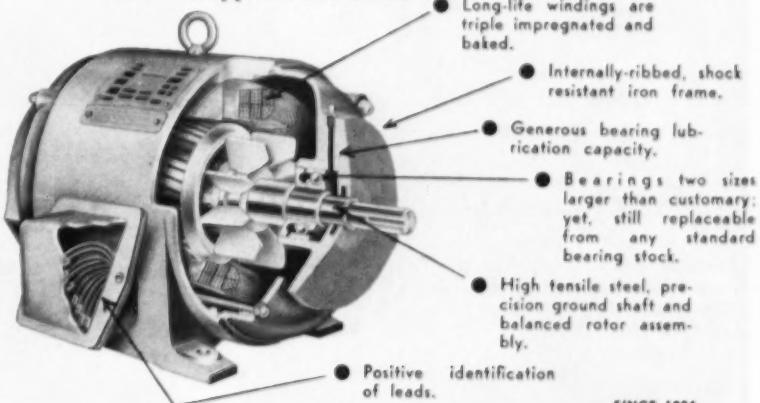
Circle 10E on reply card

Dryomatic Model 105 is an automatically regulated dual-tower dehumidifier that uses silica gel as its drying medium. It is designed primarily as a space dryer to maintain humidities down to 10 percent, in volumes as large as 35,000 cubic feet and over a wide range of temperatures. It will also provide low dew-point air for processing applications and can be used in combination with cooling equipment. The machine has a dry air output of 100 cfm and is capable of removing 50 pounds of water every 24 hours. Regeneration of the silica gel is accomplished automatically by electric heating elements. While one tower thus renews itself, the other continues to supply dry air. The self-contained unit features a valve system that allows complete separation of the dry air and reactivation air streams, thereby enabling the machine to maintain the specified low humidities.

Circle 11E on reply card

STAMINA of BROOK A.C. MOTORS is no coincidence!

Design is based on over half a century of experience. Built to surpass NEMA Specifications, yet cost no more than ordinary motors. Single and polyphase. All major types. 1 to 600 HP. Shipped from stock.



world's most respected motor
BROOK MOTOR CORPORATION

3553 W. PETERSON AVE., CHICAGO 45, ILLINOIS



Factory Representative, Warehouses, Dealers, Service Stations, in Major Cities.
Circle 27A on reply card

NON-FLUID OIL

TRADE MARK REGISTERED

PNEUMATIC TOOL EXTRAS!

New "NR" grades of NON-FLUID OILS, made specifically for all Pneumatic Tools and used and approved by most leading manufacturers of air tools—give these LUBRICATION EXTRAS:

- PLUS NO. 1. Complete rust-proofing even during indefinite downtime.
- PLUS NO. 2. Eliminates gumming and sticking of all moving parts, including fibre blades of rotary tools.
- PLUS NO. 3. High lubricity with anti-wear agent reduces friction and increases speeds up to 30%.
- PLUS NO. 4. High tool speeds mean more production of work in same number of hours used.
- PLUS NO. 5. Over-all tool maintenance costs are reduced more than 50%.

PLUS NO. 6. Winter grade available with pour point of -30°F. To test is to prove. Send now for Bulletin 550 and free testing sample of "NR" grade NON-FLUID OIL.

NEW YORK & NEW JERSEY LUBRICANT COMPANY

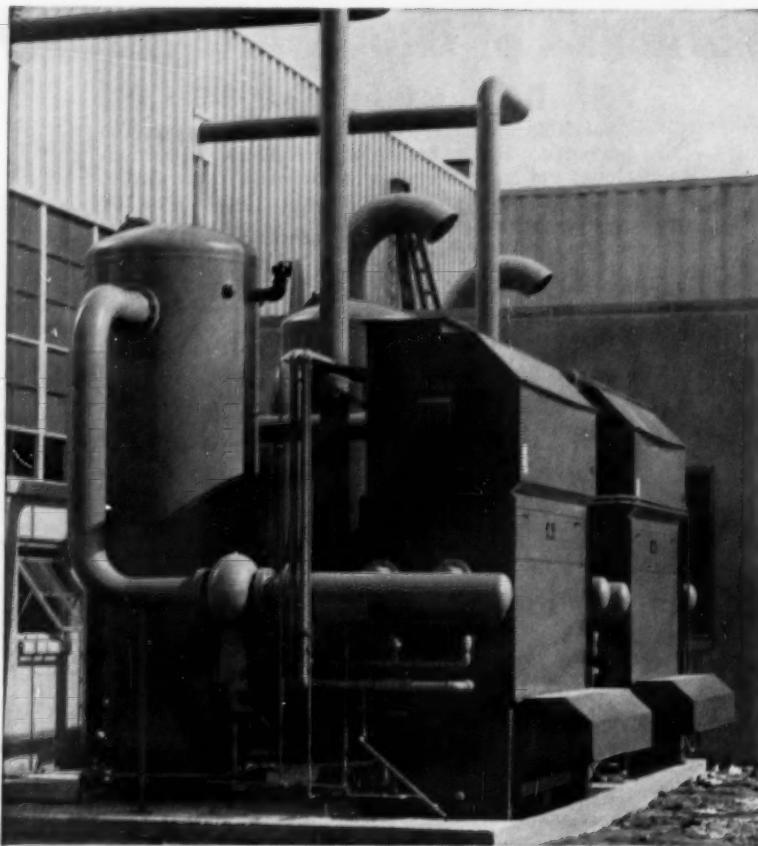
292 MADISON AVE., NEW YORK 17, N. Y.
WORKS: NEWARK, N. J.



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| | | Springfield, Mass. |
| | | St. Louis, Mo. |

NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

Circle 28A on reply card



This Niagara Aero After Cooler also cools compressor jacket and intercooler water.

COMPRESSED AIR...Lower in Cost Dependably Drier and Cooler Trustworthy for Instrument Use

THE NIAGARA AERO AFTER COOLER offers a completely self-contained method replacing both shell-and-tube cooler and cooling tower. It is independent of a large supply of cooling water and consistently reduces compressed air temperatures to below ambient. Its drier air gives you a better operation and lower costs in the use of all air-operated automatic instruments, tools and machines, paint spraying, sand blasting and moisture-free air cleaning.

Direct saving in the cost of cooling water saves the price of the Niagara Aero After Cooler in less than two years. Water saving also means less expense for piping, pumping, water treatment and water disposal, or you get the use of water elsewhere in your plant where it may be badly needed.

Niagara Aero After Cooler assures all these benefits because it cools compressed air or gas below the temperature of the surrounding atmosphere; there can be no further condensation in your air lines. It condenses the moisture by passing the air thru a coil on the surface of which water is evaporated, transferring the heat to the atmosphere. It is installed outdoors, protected from freezing in winter, proven in service on the largest plant utility air systems.

Write for complete information; ask for Bulletin No. 130

NIAGARA BLOWER COMPANY

Over 35 Years of Service in Industrial Air Engineering

Dept. CA-9, 405 Lexington Ave.

New York 17, N. Y.

District Engineers in Principal Cities

Circle 29A on reply card

BRIEFS

The Sixth Commonwealth Mining and Metallurgical Congress will be held in Canada September 8 to October 9. Approximately 500 delegates from 32 Commonwealth and other countries are expected to attend. In addition to panel discussions, technical forms and especially prepared descriptive and technical literature, field trips to all types of mineral-producing and beneficiating operations will be held. These visits will include mines, mills, oil and gas installations, chemical and petrochemical plants, steel plants and many other associated industries. The main stops will be made at Vancouver, Edmonton, Winnipeg, Toronto, Ottawa, Montreal, Quebec City and Halifax with side journeys radiating to mining properties as far north as the Yukon and many other remote areas.

Surgeon General Leroy E. Burney has announced that a total of \$37,942,326 was granted to 446 municipalities to help build sewage treatment plants during the first year of a new Federal Water Pollution control program. To this amount, communities added \$128,856,364 bringing the total estimated costs of the projects to \$166,798,690.

The world's longest periscope has been constructed by General Electric Company for installation at the AEC National Reactor Testing Station, Idaho Falls, Idaho. It is designed to aid development work on a nuclear aircraft. The 90-foot-long aluminum scope with its intricate mirror-and-lens system permits atomic workers to sit safely behind heavy shielding while watching nuclear tests.

Abbott Laboratories has reported that hospital equipment can be sterilized safely using ethylene oxide vapor instead of heat and/or steam. Using the gas permits the use of materials, such as plastic, that cannot be heat sterilized. Abbott uses the new process to sterilize injection equipment and other products in their shipping cartons. Doing so provides additional safety because both the equipment and the package absorb some of the gas, resulting in continued marked sterilizing effects.

Vast new uses for aluminum in parts subjected to high temperatures is possible according to Aluminum Company of America. Announcing the commercial availability of aluminum powder metallurgy products, the firm revealed that certain such products can withstand temperatures up to 900°F—an advance of some 300° to 400°.

The seventh annual Drilling Symposium will be held at the University of Minnesota October 3-5. It is presented through the coöperative efforts of the university's School of Mines and Metallurgy; the Center for Continuation Study; and the Mining Sub-Section, Minnesota Section, A.I.M.E. Specific topics for discussion will be geophysical instrumentation of small bore holes, weighing and reliability of drill hole samples, and air and mud as flushing media in exploration drilling.

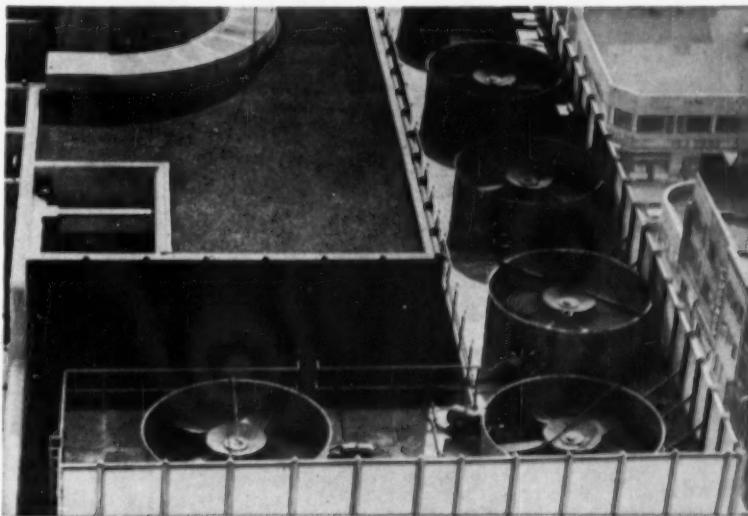
One of the world's most noted designers of bridges, O. H. Ammann, has been retained by The Port of New York Authority as design consultant for the second deck of the George Washington Bridge. Mr. Ammann designed the original structure and was Chief Engineer of the Port Authority at the time the bridge was built some 25 years ago. The project to add another deck to the structure will cost an estimated \$182 million.

The world's largest permanent magnet—weighing 1300 pounds—was recently designed for use in a mass spectrometer. Made of aluminum-nickel-cobalt-iron alloy, it is capable of establishing a holding force of 10 tons. Once magnetized and stabilized, it will reportedly retain its magnetism forever.

Keeping track of 93,000 kittens is a tough job for Chessie. The kittens are rail cars and the Chessie, of course, is the Chesapeake & Ohio Railway. The C&O has recently installed a new Car Location Information Center that utilizes 25,000 miles of servicing wires. Automatic teletypes, fed data from punched cards, notify the 56 district offices of the railway of the exact location of all cars in which the individual office has an interest.

Gotham will soon see another "glass bank" to compliment the present one on Fifth Avenue. It will be owned by Manufacturers Trust Company, as is the present one. Three sides will be glass, and banking facilities will be on both the street and concourse levels. Thus people using the underground passages to get about Rockefeller Center, will be able to bank without seeing the light of day. The new structure will be located in the Time & Life Building now under construction.

Oldest of America's engineering societies, the American Society of Civil Engineers has announced that it recently passed the 40,000 mark in membership. The group now has 75 regional sections and 63 branches. It is 105 years old.



Waldron floating shaft couplings used on nine Phillips Cooling Towers

WALDRON

flexible couplings...



Waldron floating shaft shear pin coupling

USED IN HUNDREDS
OF DIFFERENT APPLICATIONS
BUT ALWAYS FOR THE

same 3 reasons

1

STRENGTH

— Hubs and cover sleeves for sizes 1 1/4 A through 7A are machined from tough steel forgings. Hubs are keyed to the shafts. The two one-piece cover sleeves function as a single, rigid unit serving as a floating connecting link between the hubs. High strength of forgings makes possible a very compact coupling with low rotating inertia.

2

RELIABILITY

— There are no flexible parts to bend or break and the coupling is dust, moisture, and oil tight. Patented Walflex seal is at the lowest possible diameter where centrifugal force is least. Clearance between teeth in hubs and sleeve is engineered so that an oil wedge always separates them, taking the wear.

3

SERVICE

— Plenty of rough bore couplings, already assembled—on the shelf for immediate delivery. Finish bored standard couplings shipped to meet customers' schedules. We are geared up to give you realistic delivery on any type of couplings.

Ask for Catalog 57

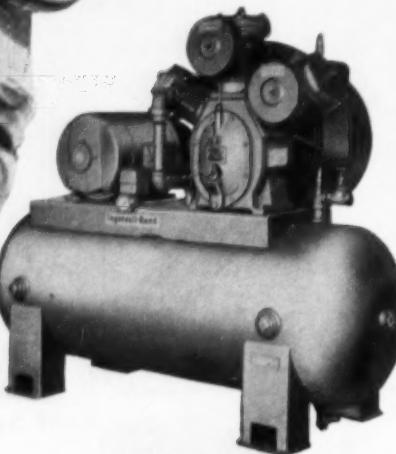
JOHN WALDRON CORP.
NEW BRUNSWICK, NEW JERSEY

Representatives In Principal Cities
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Circle 30A on reply card

*this is what it takes
to give you*

dependable air...



**Packaged Air-Cooled Compressors—
1/2 through 20 horsepower**

Other Compressors to 6000 Horsepower

You can't minimize the importance of a reliable source of compressed air.

Ingersoll-Rand Compressors are designed and built for maximum performance with minimum maintenance.

If your plant is in need of an air-cooled compressor in the 1/2 through 20 horsepower range... don't gamble, make sure you get the *Best*.

Ingersoll-Rand

11 Broadway, New York 4, N.Y.

Circle 31A on reply card

3-494

ADV. 30

(288)

**Industrial Books, Films
and Literature**

Publication of the first section of the fourth edition of the *Welding Handbook* has been announced by the American Welding Society, 33 West 39th Street, New York 18, N.Y. Written in clear language, profusely illustrated and well indexed, it serves as a text book as well as a reference work. This part, "Fundamentals of Welding," contains basic material of interest to all associated with welding activities. Divided into eleven chapters, it contains 560 pages. Whenever possible, information has been reduced to tabular form. Manufacturers, researchers, educators and men familiar with practical welding have contributed to this edition. Cost, \$9.00.

A 16-mm, black-and-white, sound motion picture describing applications of Conical Keystone Lock (CKL) blind rivets to aircraft structures is available from Huck Manufacturing Company, 2480 Bellevue Avenue, Detroit 7, Mich. *Hold It*, as it is entitled, shows the assembly of a number of typical airframe units, illustrating the ease with which the fastening process is accomplished. Special animated drawings and close-up slow-motion shots are included to give a thorough understanding of the driving cycle.

A 4-page brochure listing performance characteristics and specifications of the Skidmore-Wilhelm Manufacturing Company impact wrench calibrator and tensile tester has been published. It describes uses of the calibrator in checking threaded fastener strength, calibrating and maintenance testing of power wrenches, and setting assembly torque standards. Featured is a chart that gives ultimate strengths of standard screws in bolt sizes from 10-24 to 1 1/4-12 and in grades from low-carbon to heat-treated alloy steels.

Circle 12E on reply card

Bulletin No. 182, released by Sprout-Waldron & Company, Inc., gives the details on its Pellet Ace for the processing industry. This model forms powdered and dusty material into compressed pellets for better handling. Such pellets eliminate dust and fines when handling valuable or toxic materials and improve working conditions as well as avoid loss of materials.

Circle 13E on reply card

Marking the completion of 10 years of compilation and research, a set of data sheets giving up-to-date property information about heat-resistant cast high alloys has just been published by Alloy Casting Institute. In addition to specific

COMPRESSED AIR MAGAZINE

property data given, a concise discussion of the applications, metallurgical design and fabricating characteristic of each alloy is presented.

Circle 14E on reply card

Portable, industrial x-ray equipment that provides accuracy in radiographic inspection of castings, welds and assemblies, and facilitates improvements and repairs on metal products, is illustrated and described in a 4-page folder that has been released by Mitchell Radiation Products Corporation. Three compact units are presented. Each features built-in high-tension transformers; simplified, color-coded technique charts on the face of the control panels; and protective devices for overloads, high and/or excessive voltage and extreme oil temperatures.

Circle 15E on reply card

A complete line of equipment designed for use in applications of Air Reduction Company, Inc.'s tungsten arc Heliweld process is illustrated in a 20-page catalogue (No. 2300). Advantages of the process and the factors that determine equipment selection are covered. It contains information about manual, semi-automatic, and automatic equipment, and accessory devices. Several pages are devoted to the selection of electrodes and filler wires.

Circle 16E on reply card

Colorful 14 1/2x20 1/2-inch safety posters stressing the connection between neat stockrooms and prevention of accidents are being offered free of charge by Deluxe Metal Furniture Company. The three posters are headed *Good Housekeeping Prevents Accidents, Orderliness Prevents Accidents and Neatness Prevents Accidents.*

Circle 17E on reply card

W-S Fittings Division of H.K. Porter Company, Inc., has made available a 4-page bulletin (No. CP-1-57) describing its complete line of couplet connections for tanks, pressure vessels and pipelines. Included are dimensional and specification data on the screw-end, socket-welding and 90-degree-elbow couples.

Circle 18E on reply card

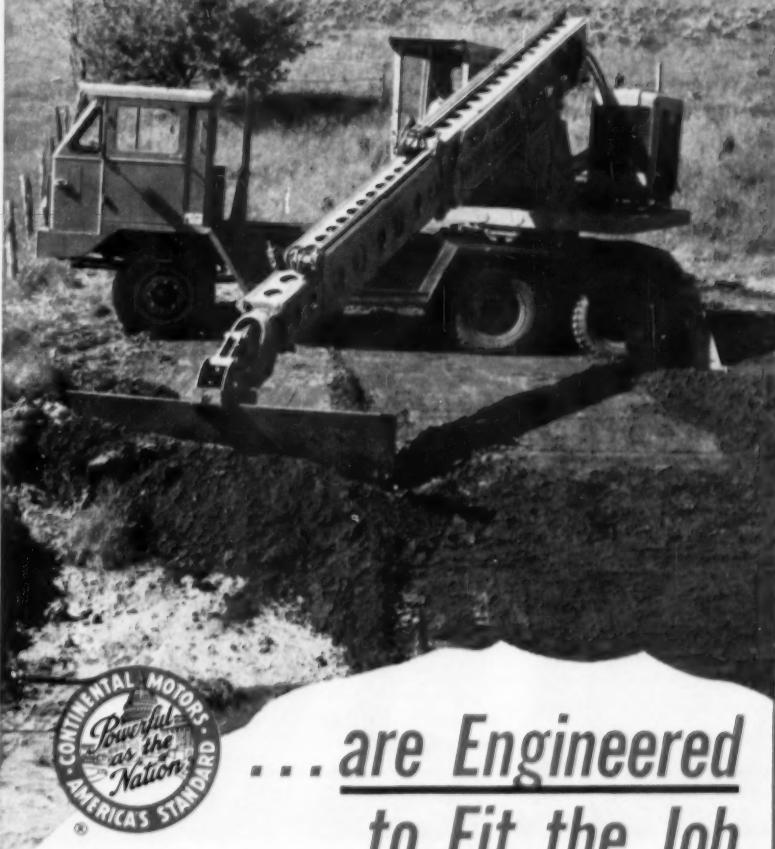
The American Pulley Company has announced its Screw-King conveyor drives in Catalogue No. SCD-57. By means of tables and specific instructions, the proper drive for individual installations can be rapidly selected.

Circle 19E on reply card

Ford Tractors and Their Industrial Applications is a 12-page illustrated brochure showing Ford Motor Company's tractors and industrial equipment in action, and including abbreviated specifications.

Circle 20E on reply card

CONTINENTAL RED SEALS



... are Engineered
to Fit the Job

You find Red Seals on the job, wherever there's a job to be done—in excavating, ditching, concrete ripping, grading, building, and all phases of road construction. You find them powering the equipment of manufacturers who recognize the importance of the "engineered for the job" features, and the day-in, day-out dependability of Continental Red Seal engines and power units. . . . The Badger Machine Company's Model 360 Hydro-Skopic Hopto, shown above, is powered by a Continental Red Seal Model B427. This installation is another fine example of expert matching of the engine to the rest of the machine. It's wise, when buying equipment of this type, to choose a make with Red Seal power. You get an engine which is not only tailored to the job, but backed by specialized experience dating from 1902.

SERVICE FACILITIES AND GENUINE RED SEAL PARTS ARE AVAILABLE EVERYWHERE

WORLD'S LEADING INDEPENDENT MANUFACTURER OF INTERNAL COMBUSTION ENGINES.
CONTINENTAL MOTORS OPERATES PLANTS IN ATLANTA, DALLAS, DETROIT, MILWAUKEE,
MUSKEGON, AND TOLEDO, AND IN ST. THOMAS, ONT., PRODUCING AIR-COOLED AND LIQUID-COOLED ENGINES FOR USE ON LAND, AT SEA AND IN THE AIR.

Continental Motors Corporation
MUSKEGON • MICHIGAN

Circle 32A on reply card



New
Atomic-powered
"SKATE"
equipped with
Fulfilo
FILTERS

Photo courtesy of General Dynamics Corp.

When the *Skate*, U. S. Navy's newest atomic submarine, slid down the ways, she was equipped with Fulfilo Filters.

When you need dependable micronic filtration, you, too, can rely on Fulfilo Filters. They are engineered to your exact requirements — for all types of industrial fluids: oils; liquid chemicals; water; liquid

fuels; lacquers, paints, thinners; compressed air, CO₂ and other gases. Standard models meet all normal operating conditions. Special filters can be engineered for full-flow filtration up to 2000 gpm or pressures as high as 5000 psi, at minimum pressure drop. Wide variety of filter elements and containers is available.

Call on Commercial for dependable micronic filtration. For technical literature or engineering assistance, address Department CA.

*Micro-Fine Filtration
for Low Cost Clarity*



FULFILO FILTERS WITH GENUINE HONEYCOMB FILTER TUBES FOR CONTROLLED MICRONIC CLARITY • CFC MULTI-CARTRIDGE OIL FILTERS
PURIVAC INSULATING OIL CONDITIONERS • DRI-PURE WATER-OIL SEPARATORS • PRE-COAT FILTERS • MAGNETIC SEPARATORS
AUTOMATIC TUBULAR CONVEYORS • COOLANT CLARIFIERS

COMMERCIAL FILTERS CORPORATION

MELROSE 76, MASSACHUSETTS

Plants in Melrose, Massachusetts and Lebanon, Indiana

PORTABLE AIR COMPRESSOR



this 85 cfm **GYRO-FLO**
means new
performance and economy
for your small air-power jobs

Now you can have a Gyro-Flo rotary compressor to match your smallest jobs. Weighing only 1840 lb, this newest addition to the famous Ingersoll-Rand Gyro-Flo line offers extra convenience and lower air power costs for the many applications where a larger compressor is not required. For complete information, send today for a copy of Form 2307.

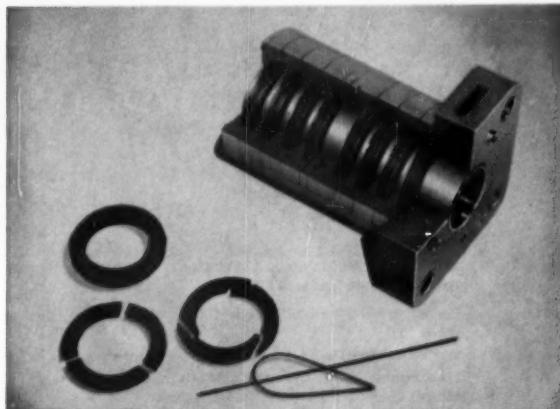


Ingersoll-Rand

11 Broadway, New York 4, N.Y.

2-611

Circle 34A on reply card



**Look to COOK for Better
CARBON PACKING RINGS!**

Cook carbon packing rings are made of a special carbon graphite material that automatically assures you *high resistance to wear, chemical inertness and excellent heat conductivity*.

If you have sealing requirements for non-lubricated compressors, write today for a sample carbon ring, plus

literature on Cook's complete line of packing materials. Address C. Lee Cook Company, 930 South Eighth Street, Louisville 3, Ky.

**C. LEE
COOK
COMPANY**

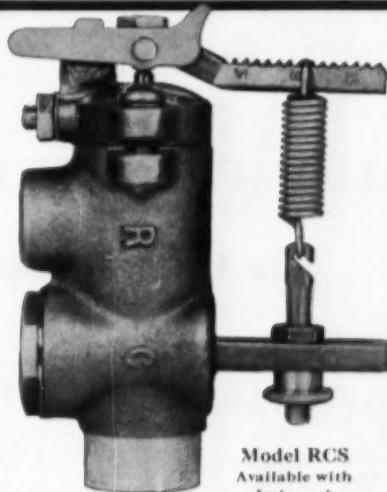
Sealing Pressures Since 1888

Circle 35A on reply card

SEPTEMBER 1957

CONRADER UNLOADER VALVES

Positive . . . Accurate . . . Dependable
Time-tested the World Over



Model RCS
Available with
drain cock

New Designs—Smaller—More Compact

Positive operation in any position.

Adjustable differentials.

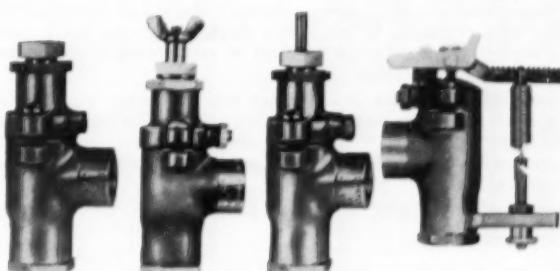
Operating pressures from 4 p.s.i. to 600 p.s.i.

Standard on leading compressors.

Conrader's exchange service trades you a completely rebuilt valve for an old one with new valve guarantee.

One day service on repairs.

Conrader is equipped to custom design special valves in pressures to 1000 p.s.i.



Model RCW Model RCM-A Model RCM-A with hand unloader Model RCF

Distributor Franchises Open

R. CONRADER COMPANY INC.

Box 924, Erie, Pa.

Circle 36A on reply card

Adv 33

Fast...
Positive!

Quarter-Turn Control for Compressed Air Lines



GRINNELL- SAUNDERS DIAPHRAGM VALVES

Simple operating principle A double-acting cam lowers the valve stem smoothly and with relatively little effort for fast, positive closure. Raising the stem to open the valve, in the 2-inch size, is accomplished by this same cam. In all the smaller sizes, return spring action replaces cam action in opening the valves.

Eliminates Compressed Air Leaks Designed specifically for compressed air lines, the Grinnell-Saunders Diaphragm Valves give positive leakproof closure. A flexible diaphragm, seating on metal, assures this perfect seal. At the same time, because working parts are wholly isolated, no packing glands are necessary, and stem leaks are impossible.

Variety of Applications In the smaller sizes, the quarter-turn, lever-operated Grinnell-Saunders Diaphragm Valve is ideal for air-operated tools, presses, clamps, molds, or wherever fast control is requisite. In the larger sizes, it supplies quick control of air agitators, or large headers at compressors where speed may be a safety factor.

Lower Maintenance is a further big advantage you get with Grinnell-Saunders Valves. No refacing or reseating is required. No packing glands to demand attention. And diaphragm replacement can be made simply, without removing valve body from the line.

For further details, write for Grinnell-Saunders Diaphragm Valve Catalog.

GRINNELL
WHENEVER PIPING IS INVOLVED



Grinnell Company, Inc., Providence, Rhode Island

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermalier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems



SIZES: 1/2 to 2-inch

CHOICE OF MATERIALS

Bodies — iron; cast steel; stainless steel; Durimet 20; Hastelloy A, B, C; bronze; Monel; aluminum; PVC (polyvinyl chloride); Saran

Body linings — hard rubber; soft rubber; neoprene; glass; lead; plastics; Heresite; Lithcote

Diaphragms — soft natural rubber; natural rubber; white synthetic rubber; neoprene; reinforced neoprene; butyl; Hycar; Teflon; Kel-F; PVC (polyvinyl chloride); polyethylene

Bonnets — iron; stainless steel; bronze; other materials on special order

CHOICE OF BODIES

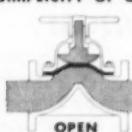
Straight bodies — screwed; flanged; socket weld; butt weld; socket (solder); sanitary threads; hose ends; Victaulic

Angle bodies — screwed; flanged; socket weld

OTHER BONNETS: 1/4 to 18-inch

Handwheel (non-indicating stem, indicating stem) 1/4 to 18-inch; sliding stem (for a wide selection of power operated top-works), 1/2 to 12-inch.

SIMPLICITY OF OPERATION



Diaphragm lifts high for streamline flow in either direction



Diaphragm presses tightly against the valve seat for air-tight closure

ONE OF THE GARLOCK 2,000

Wet and Dry Tests Prove...



GARLOCK 662 GASKET MATERIAL *does not shrink or change shape*

Here's convincing proof that gaskets of Garlock 662 can stand varying climatic conditions without drying, shrinking, or hardening. The gaskets illustrated were subjected to a 24-hour alternating wet and dry test for weeks, then conditioned at room temperature. As the photo and chart at right show, 662 gaskets returned to their original shape and to within 1% of their original thickness. Competitive types hardened, twisted, and shrank as much as 8%. No wonder so many companies are specifying 662 for use against gasoline, water, and oil at temperatures up to 300°F. It is approved by Underwriters' Laboratories, Inc., for use against hazardous liquids.

And longer-lasting 662 Gasket material is only one of "the Garlock 2,000" . . . two thousand styles of gaskets, packings, and seals to meet all your needs. It's the only complete line. It's one reason you get unbiased recommendations from your Garlock representative.

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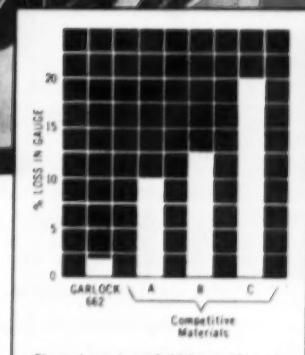


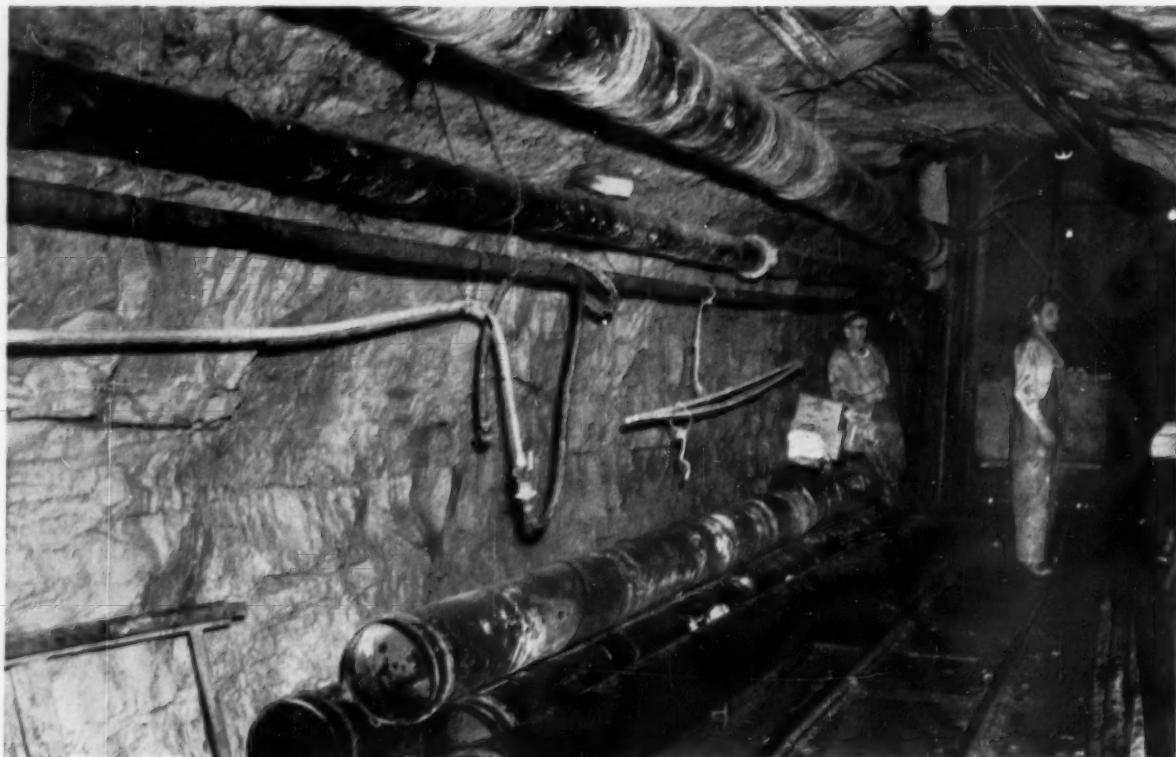
Chart shows loss of thickness after alternating wet and dry exposure tests. Garlock 662 returns to within 1% of original thickness. You can make these tests yourself. You'll prove that No. 662, made from a cork paper base impregnated with a synthetic rubber, is dimensionally more stable than competitive products.

Write for

this folder AD159
which completely describes
how these Wet and Dry
Tests were made . . . it also
contains actual samples
of 662 Gasket material
before and after testing.



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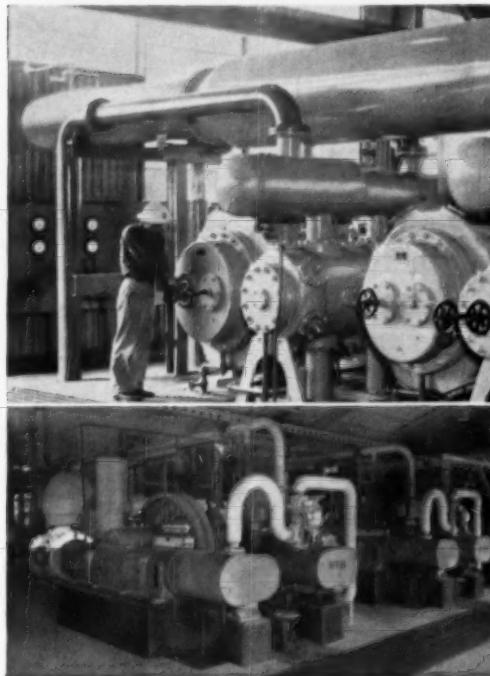
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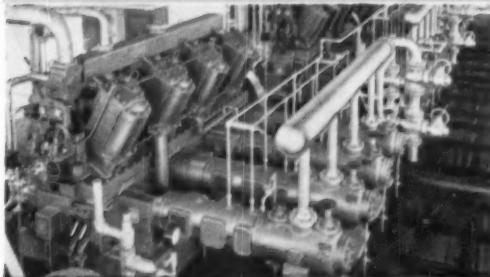
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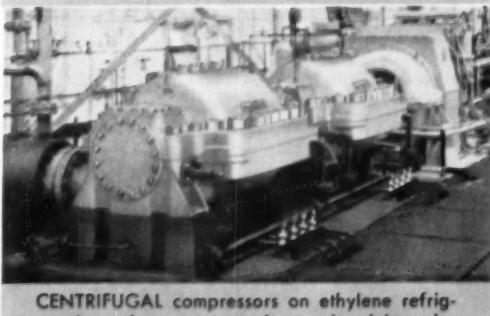
what assures a GOOD COMPRESSOR for PROCESS WORK?



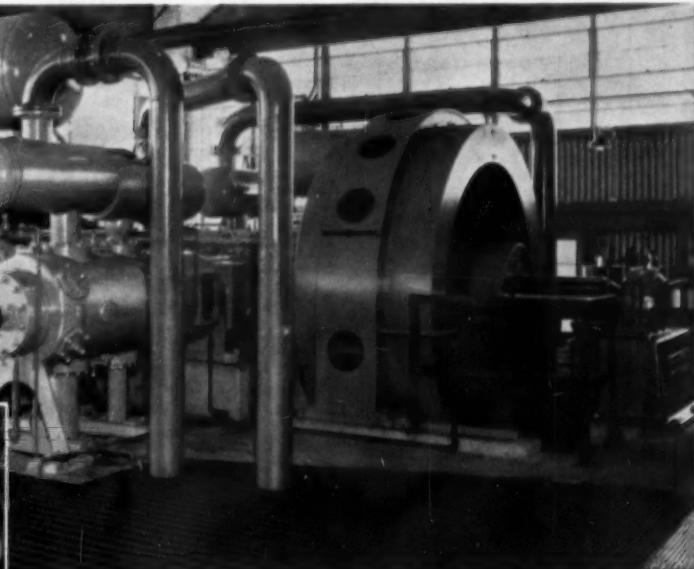
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GAS-ENGINE compressors with non-lubricated compressor cylinders on hydrogen recycling duty at a Southern refinery.



CENTRIFUGAL compressors on ethylene refrigeration; these are tandem units driven by steam turbine.



ELECTRIC-DRIVEN horizontal 4000-hp HHE compressor on multiple-gas service, compressing air to 645 psi, nitrogen to 330 psi and natural gas to 440 psi simultaneously in an ammonia plant.

In process jobs, any interruption of the cycle often means large loss of production, expensive repairs, and introduction of hazardous conditions. In manufacturing compressors for these jobs, there is one ingredient most vital.

That ingredient is knowledge. The compressor manufacturer must know how to predict conditions in the process which might force a shutdown, and must know how to meet those conditions with a compressor which will minimize the possibility of a shutdown.

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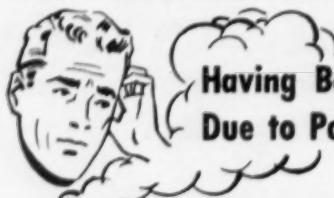
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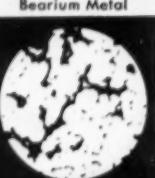
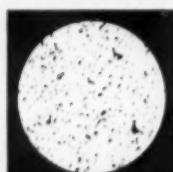
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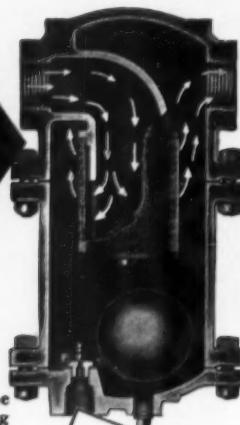
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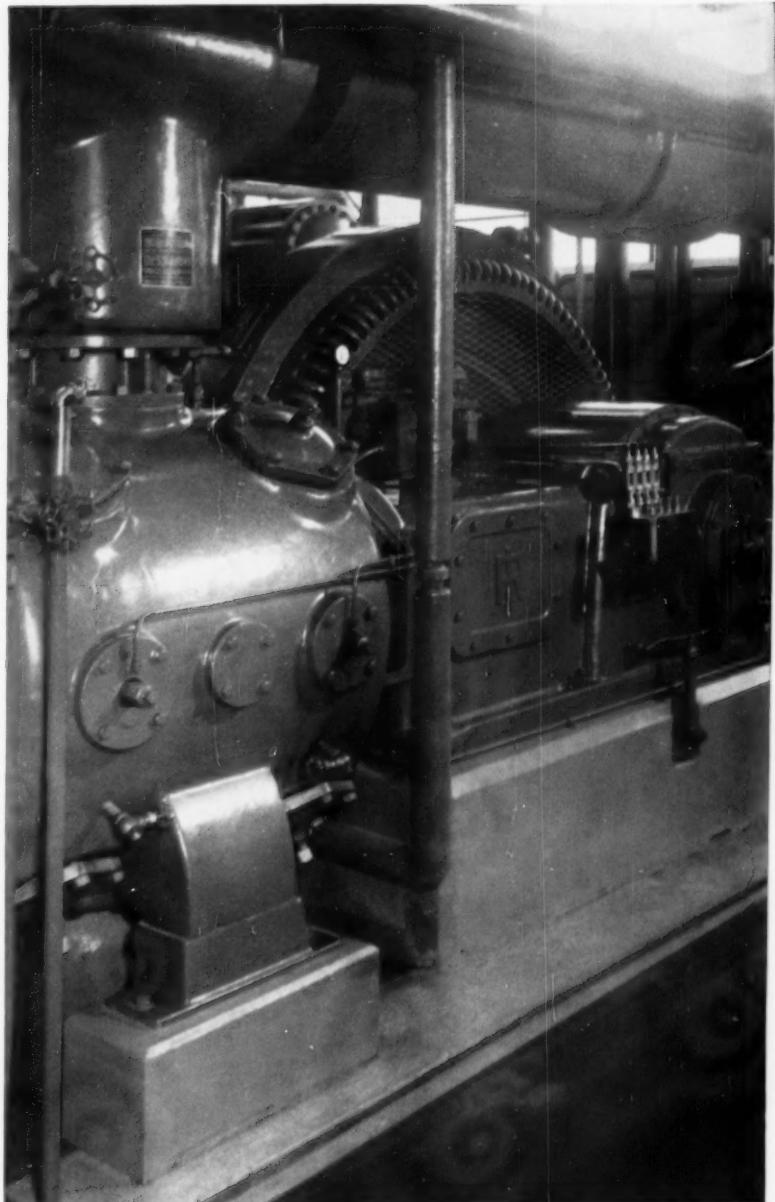
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